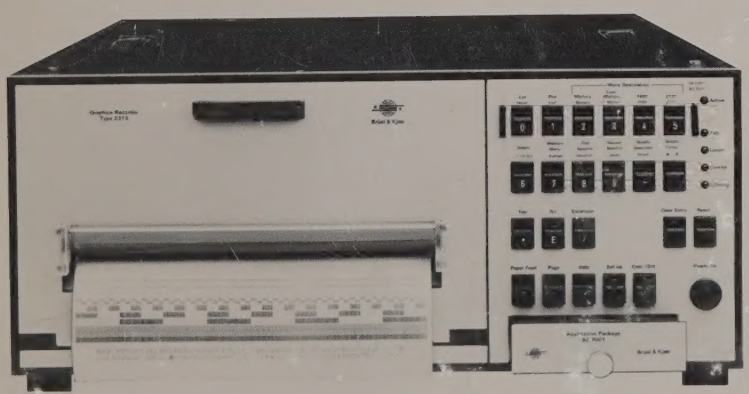
2313
BZ 7001

Instruction Manual

Graphics Recorder Type 2313
plus Application Package BZ 7001



A highly versatile alphanumeric printer and graphics recorder for use with digital measuring and analyzing equipment furnished with an IEC/IEEE interface. Togetner with Application Package BZ 7001 it offers fast, fully annotated graphic plots of measured 1/1 and 1/3 octave frequency spectra as presented on the display screen of the B&K Digital Frequency Analyzers Types 2131 and 3360 in as little as 10 seconds. Also a variety of special tasks can be carried out, such as storage of measurement results, reformatting of data for amplitude/frequency-/time mapping, sum, difference and average spectra etc., plus 4-pass 1/12 octave analysis. For use with other B&K measuring and analyzing equipment, the 2313 may be fitted with range of other Application Packages.

Brüel & Kjær

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METROLOGY LAB.
DO NOT REMOVE
FROM AREA

GRAPHICS RECORDER TYPE 2313
PLUS
APPLICATION PACKAGE BZ 7001

From serial no. 973241

June 1984

SAFETY CONSIDERATIONS

This apparatus has been designed and tested according to Class II of IEC Publication 348, Safety Requirements for Electronic Measuring Apparatus, and has been supplied in safe condition. The present Instruction Manual contains information and warnings which should be followed by the user to ensure safe operation and to retain the apparatus in safe condition. Special note should be made of the following:

APPLICATION OF POWER

Before each use of the apparatus, check that it is set to match the available mains voltage and that the correct fuse is installed.

SAFETY SYMBOLS

⚠ The apparatus will be marked with this symbol when it is important that the user refer to the associated warning statements given in the Instruction Manual.

⊥ Chassis terminal ⏚ Safety earth terminal ↯ Hazardous voltage

WARNINGS

Whenever it is likely that the correct function or operating safety of the apparatus has been impaired, the apparatus must be made inoperative and be secured against unintended operation.

Any adjustment, maintenance and repair of the open apparatus must be avoided as far as possible and, if unavoidable, must be carried out only by trained service personnel.

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Graphics Recorder

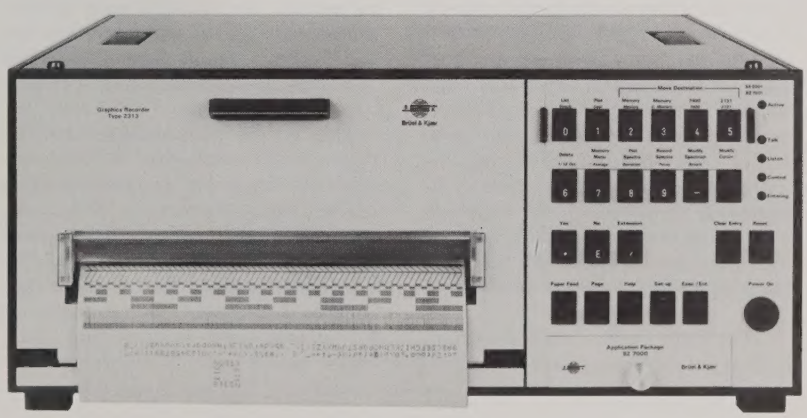
USES:

- Dot-matrix printer for plotting measured spectra presented on the display screen of B&K digital measuring or analyzing instrumentation, plus documenting front panel control settings etc.
- Versatile system controller for instruments equipped with IEC/IEEE digital interface bus
- Digital recorder for storage of spectra and front panel control setting data
- Reformatting of data for new types of measurement. Extends measurement capability of B&K equipment

FEATURES:

- High-resolution graphic and alphanumeric print out using fixed 512 point print head with 0,2 mm step paper feed
- Accepts 210 mm wide rolls of metallized paper. One 50 m roll equivalent to 160 A4 charts
- 96 standard and 32 special alphanumeric characters according to ISO 646 and 2022 standards
- Range of plug-in Application Packages available to suit the individual documentation and measurement needs of B&K measuring and analyzing equipment
- Built-in crystal controlled clock for print out of date and time together with measurement results
- Continuous and volatile memories for storage of measurement spectra
- Choice of Operating Set-Ups for specifying type of print out, memory allocation and measurement functions
- Simple, easy to follow pushkey operation, plus extensive "Help" file for step by step guidance of first time users

Introduction



The Graphics Recorder Type 2313 is a highly versatile alphanumeric and graphics printer for use with B&K digital measuring and analyzing instrumentation equipped with an IEC interface bus. Together with an appropriate Application Package it offers fast, fully annotated, graphic plots of frequency spectra, time functions etc., as presented on the display screen of B&K instruments. In addition, it may be employed as a conventional alphanumeric/graphics printer for documenting data transmitted by other digital equipment furnished with an IEC or IEEE interface.

Besides documentation of data, the 2313 is capable of performing a variety of other important tasks for which extra equipment would normally be required. Using its continuous and volatile memories, for example, several hundred complete measurement spectra can be recorded and stored for future print out or transmission to other equipment. Also, new types of measurement can be generated from stored and incoming data, plus use as a system controller is possible. Thus, whatever measuring instrumentation is employed, the 2313 opens up a whole new range of measurement possibilities and applications.

Description

Writing System

The writing system of the 2313 accepts 210 mm wide rolls of electrosensitive paper QP 4690. Two 50 m rolls are supplied with the Recorder, each providing the equivalent of 160 A4 (metric) size charts. The paper is of the readily available metallized type and produces clear well defined print that is not susceptible to fading as with chemically treated types.

When loaded in the 2313, the metallized surface of the paper contacts a fixed, single-element, print head. This is accessible via the paper outlet slot on the front panel to facilitate easy cleaning and to achieve a high resolution print has 512 individual electrodes. These are spaced at 0,4 mm intervals and span almost the complete paper width giving a maximum line width of 205 mm.

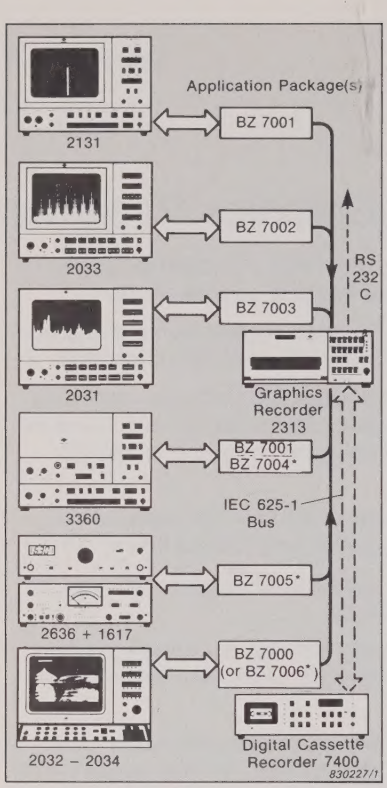


Fig. 1. Interchangeable Application Packages and Digital Frequency Analyzers for use with the 2313. Packages planned for release in the near future, are marked with an asterisk

For well formed characters and graphics, the paper is evenly accelerated and decelerated past the print head in 0,2 mm steps. Utilizing the plot mode for 512-point graphics, the maximum print rate is 46 lines per second. Due to the relatively smooth transition from one line to the next, relatively quiet operation is obtained.

In the print mode a total of 96 standard upper and lower case characters may be called on, plus 32 special characters. These are according to ISO 646 and 2022 standards respectively, and are based on a 6 by 8 point matrix. For enhancing different text four character sizes up to 12,8 mm may be chosen, which enable between 46 and 85 characters per line to be printed. In addition line spacings between 0,4 and 2,8 mm may be selected. The print rate depends on the size and number of characters printed and is between 3 and 9 lines per second.

If required text and graphics can be mixed by changing from the print to plot mode (or vice versa) at the start of a new line. Text and graphics may also be justified to the left or right margin of the paper and for filing in standard binders there is a "Page Feed" function for advancing the paper the remainder of one A4 or 11 inch chart.

Application Packages

As standard the Application Package BZ 7000 is included with the 2313. This plugs directly into a port on the front of the Recorder and facilitates use of the 2313 as a conventional alphanumeric/graphics printer as well as permits direct copying of spectra presented on the display screen of the B&K Dual Channel Signal Analyzers Types 2032 and 2034.

Also for use with the 2313 are the Application Packages BZ 7001 to BZ 7006. These are available as extra and especially convert the 2313 to suit the individual documentation needs of the B&K Digital Frequency Analyzers shown in Fig. 1. Furthermore they provide a range of special functions for storage and reformatting data, which enable new types of measurement to be made using the analysis equipment shown.

Note: For direct copying of measurements presented on the display screen of the B&K Dual Channel Signal Analyzers Types 2032 and 2034, any Application Package may be employed, including BZ 7000.

Documentation

Common to all Application Packages, except BZ 7000, are "List" and "Plot" functions. Both are selectable using the pushkeys of the Recorder and provide fully annotated, hard-copy documentation of measured frequency spectra and/or time domain functions in as little as 10 seconds. Examples of the two types of documentation are shown in Fig. 2 and 3 respectively. Generally graphic plots of spectra resemble those presented on the display screen of B&K Digital Frequency Analyzers, except that they also have fully annotated measurement axes and include front panel control setting information plus the date and time of the readout.

If desired two separate spectra can be plotted simultaneously. Also, documentation may be modified to suit the specific signal analyzed. The latter is accomplished by selecting any one of three independent "Operating Set-ups" stored in the Recorder. These provide access to the different control functions of the particular package employed, permitting the user to change or select individual control parameters using the pushkeys of the Recorder. For example, different amplitude axes and offsets may be chosen or autoranged to correspond with the maximum signal level, only data within a user-defined frequency

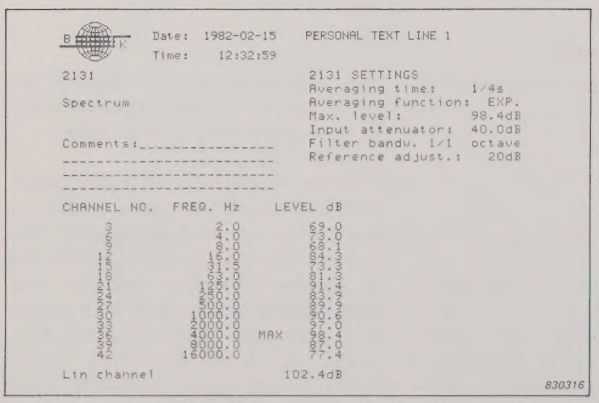


Fig. 2. Typical listing of 1/1 octave analysis data, printed by the 2313 Graphics Recorder with Application Package BZ 7001

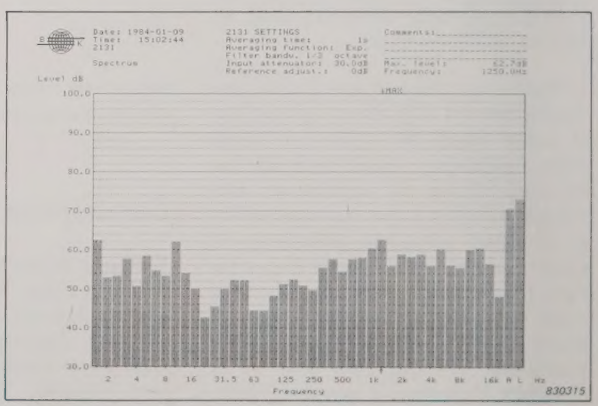


Fig. 3. Typical 1/3 octave analysis, printed by the 2313 Graphics Recorder with Application Package BZ 7001

range printed, and measurement axes graduated directly in dB and Hz or standard engineering units of Pa, ms^{-2}, mV etc.

Storage

The 2313 includes both continuous and volatile memories. These enable measured spectra and other data transmitted by particular equipment for which the Application Package is designed, to be individually filed during the course of measurements. Stored spectra may then be recalled at some other time for comparison with later incoming data or may be saved and reformatted for new types of measurement.

With the continuous memory approximately ten sets of complete spectra may be stored, whilst with the volatile memory storage of several hundred sets is possible (see Specifications). Also, a 100 step pushkey sequence can be entered, enabling a whole series of measurement, storage and documentation functions to be carried out completely automatically. For identification and quick location of data, a "Memory Menu" function can be activated which lists file numbers along with other main data concerning stored measurements.

To help safeguard stored data, special provision is made for securing consecutive memory files. Whereas the volatile memory is intended only for temporary storage, data stored in the continuous memory can be retained more-or-less indefinitely provided that the 2313 is subjected to regular use.

Measurements

An important feature of the 2313 is that it is capable of reformatting stored and incoming spectra, enabling new types of measurement to be documented, without having to use or especially program other equipment for the purpose.

The different types of measurement available cover production of sum, difference and average spectra, sound contour and 3D plots, 3-parameter (amplitude/frequency/time) mapping of single events etc. Furthermore, 1/1 or 1/3 octave spectra may be assembled from narrow-band data transmitted by Frequency Analyzers Types 2031 and 2033, or a 1/12 octave – 4 pass analysis carried out in conjunction with Frequency Analyzer Type 2131. See Fig.4 and Specifications.

Stored spectra may also be individually modified using the pushkeys of the Recorder. This is valuable for eliminating unwanted components, as well as for generating different reference spectra for comparison with incoming data.

Built-in Clock

All internal operating sequences are governed by a built-in clock generator. For data logging purposes there is a calendar function enabling both date and time to be automatically recorded at the head of each data file stored or documented with the Recorder. If need be the clock may be set to initiate a series of readouts at preselected intervals ranging from 1s to 24 hours, and/or start a control sequence after both a preset level and time have been exceeded. This is useful in airport noise surveys, machine surveillance for preventive maintenance etc.

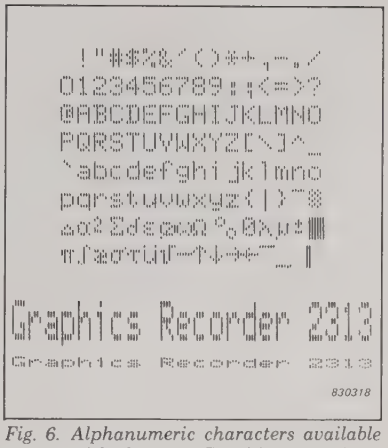


Fig. 6. Alphanumeric characters available with the 2313 Graphics Recorder

Digital Interface and System Control

System control, plus digital input and output of measurement data, takes place via the IEC/IEEE Interface of the 2313. This enables a large number of instruments with compatible interface to be connected directly on-line with the Recorder. However, where more than digital input of data and manual operation of the measuring system is required, the 2313 must be fitted with an Application Package other than BZ 7000.

A notable feature of the Application Packages BZ 7001 to BZ 7006, is that they permit all information transfer over the IEC /IEEE bus of the measuring system to be governed by the

Fig. 4. Typical 1/12 octave – 4 pass analysis obtained using the 2313 Graphics Recorder with Application Package BZ 7001

Fig. 5. Typical graphics plot printed directly from the 2032 (or 2034) Signal Analyzer using the 2313 as a conventional graphics recorder with Application Package BZ 7000

2313. As a result the entire measurement system may be operated via the interface and front panel pushkeys of the Recorder. For instance, using a simple pushkey command, measurements displayed on the Frequency Analyzer may be sent to the Recorder for documentation or storage, or if required may be relayed to another device such as a 7400 Digital Cassette Recorder. Similarly, tape recorded data may be documented or stored in one of the continuous or volatile memories of the 2313, provided that this originates from the Frequency Analyzer for which the Application Package is designed.

Provided along side the IEC interface, is an RS 232C Serial Interface. This provides a secondary means of remote control of the 2313 and other equipment covered by its Application Package, plus permits entry of personal text in the documentation presented by the Recorder (see Fig. 4). Alternatively, personal text may be entered via the front panel pushkeys of the 2313.

Specifications 2313

WRITING SYSTEM:
Dot-matrix printing on Electrosensitive Paper QP 4690 using fixed 512-point print head with line width of 205 mm

Print Mode:
96 standard plus 32 special 6 by 8 matrix characters according to ISO 646 and 2022
Characters per Line: Selectable between 46 and 85
Character Height: Selectable 1,6; 3,2; 6,4 or 12,8 mm
Line Spacing: 0,4 to 2,8 mm
Print Rate: 3 full lines of 3,2 mm high characters per second corresponding to 250 characters per second

Graphics Mode:
Resolution: 25 dots/cm (63 dots/in)
Line Width: 204,4 mm
Line Spacing: 0,2 mm
Print Rate: 46 lines per second

PAPER DRIVE:
Step Length: 0,2 mm
Chart length: 297 mm A4 (metric) or 11 in (English) chart length
Page: Advances paper remainder of selected A4 or 11 in chart
Out of Paper: Warning printed plus paper drive automatically terminated at end of paper roll

IEC 625-1 STANDARD INTERFACE:
For system control plus digital input and output of data to be documented.

Connector: Standard 25-pin connector accepting Cable AO 0194 for connection to an IEC 625-1 interface system. Connection into an IEEE 488 interface system is made using Cable AO 0194 plus Adaptor AO 0195
Functions Implemented: Source Handshake (SH 1), Acceptor Handshake (AH 1), Talker (T 5), Listener (L 3), Service Request (SR 1), Remote Local (RL 1), Parallel Poll (PP 1), Device Clear (DC 1), Controller (C 1 to 5)
Transmission Speed: ~100 kbytes/s with direct memory access
System Control: Manual operation or use as system controller in accordance with Application Package
Job Specifications: Accepts job specification commands in IEC 625-2/IEEE Std. 728 format

RS-232C SERIAL INTERFACE:
For digital input of personal text
Connector: 25-pin (female) wired as DCE device
Transmission Speed: Selectable up to 9600 Baud

REMOTE CONTROL:
8-pin DIN socket providing make and break lines for control of external sound source, audible alarm, warning lamp etc. Maximum throughput 0,25 mA/200V

TEMPERATURE RANGE:
Operation: 5 to 40°C (41 to 104°F)
Storage: –25 to 70°C (–13 to 158°F)

MAX. HUMIDITY: 90% RH (non condensing at 30°C)

ELECTROMAGNETIC COMPATIBILITY:
Complies with Class B Device of the American FCC Rules

POWER REQUIREMENTS:
Complies with IEC 348 Safety Class II
Supply Voltage: 100; 115; 127; 200; 220; 240 V (50 to 60 Hz) ±10% AC
Power Consumption: 60 VA nominal (160 VA max. instantaneous)

CABINET:
Supplied as Model A (light-weight metal cabinet) or Model C (as A but with flanges for standard 19 in rack)

DIMENSIONS:
Metal cabinet, excluding knobs and feet
Height: 177 mm (7,0 in)
Width: 430 mm (16,9 in)
Depth: 500 mm (19,7 in)

WEIGHT: 17 kg (37,5 lb)

ACCESSORIES INCLUDED:

1 × Mains Cable	AN 0020
2 × 50 m Roll of Recording Paper	QP 4690
1 × 8-pin DIN Plug	JP 0802
1 × 25-pin IEC 625-1 Bus Connector Kit	UA 0793
1 × 25-pin RS-232C Male Connector	JP 2500
1 × Application Package	BZ 7000*

ACCESSORIES AVAILABLE:

50 m Roll of Recording Paper	QP 4690
25-pin IEC 625-1 Interface Cable (2 m)	AO 0194
25-pin IEC (male, slide-lock) to IEC 625-1 Interface Cable (2 m)	AO 0184
25-pin Adaptor for Coupling into IEEE 488 Interface System	AO 0195

APPLICATION PACKAGES AVAILABLE:

BZ 7001 for Digital Frequency Analyzer Type 2131 and Sound Intensity Analyzer System Type 3360. Lists and plots 1/1 and 1/3 octave spectra. Stores 200 spectra plus 1 auto. control sequence. Genenerates "Lin" and "A"-weight channel – adds, subtracts and averages spectra – multiple plots of up to 40 spectra – 1/12 octave analyses – reverberation and decay measurements – 3-parameter (amplitude/frequency/time) maps. Clock, trigger and wait functions also included.

BZ 7002 and 7003 for Digital Frequency Analyzers Type 2033 and 2031 respectively. List and plot time functions plus narrow-band spectra. Stores approx. 60 spectra or 25×1k (2×10k) time functions, plus 1 auto. control sequence. Generate "Lin" and "A"-weight channel – 1/1 and 1/3 oct. spectra – distortion spectra – average spectrum and standard deviation. Also integration and differentation functions, as well as choice of autoscaling and engineering units.

BZ 7004 for Sound Intensity Analyzer System Type 3360.** Similar to BZ 7001, but with sound power measurements, sound contour and 3D plots (pressure and intensity) and source localization instead of 3-parameter mapping, average and multiple plots.

BZ 7005 for Measuring Amplifier Type 2636 plus Band Pass Filter Type 1617.** Similar to BZ 7001, but with L_{eq} measurements, autoranging of 2636 for extended dynamic range, plus remote control of 1617 and BT product

BZ 7006 for Dual Channel Signal Analyzers Types 2032 and 2034**

For more detailed information and specifications concerning the respective Application Packages, please consult your local B&K representative.

*BZ 7000 permits use as conventional alphanumeric printer, plus direct copying of measurements displayed on Analyzers Types 2032 and 2034. For graphic plots with other B&K Analyzers, the Application Packages listed under Accessories Available should be employed.

**Planned for release in the near future.

2. CONTROLS

2.1. FRONT PANEL

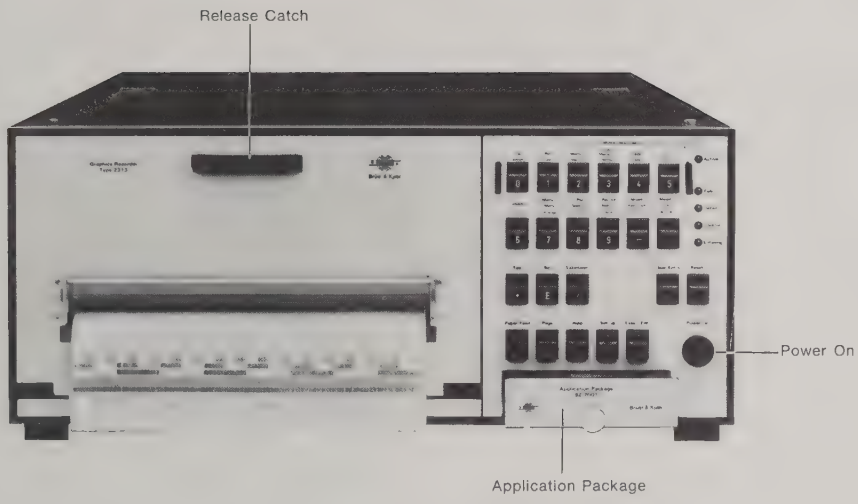


Fig. 2.1. Front panel of the Graphics Recorder Type 2313

Power On: On-Off switch for mains power. When set to **Power On**, either the **Active** or **Entering LED** at the top right hand corner of the front panel should light, accompanied by a print out of date and time.

Release Catch: Press down and pull to hinge forward the paper drive mechanism. See section 3.7 for details on paper loading and cleaning of the print head.

Application Package: Plug-in module determining the operating functions available with the Recorder, including with which measurement and analysis equipment the Recorder may be used. For documentation, storage and reformatting of measurement data transmitted by the B&K Digital Frequency Analyzers Types 2131 or 3360, the Application Package BZ 7001 is employed. See section 3.6.

At the top right of the instrument are two rows of pushkeys. These are shown in Fig. 2.2 and are for keying in numerical data with the **Set-Up** mode of the Recorder, plus specifying memory and tape files to and from which measurement data is to be relayed for documentation and storage etc.

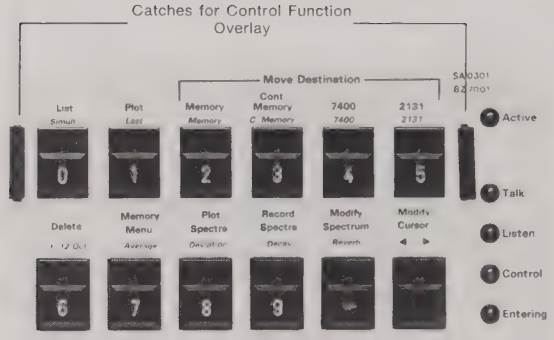


Fig. 2.2. Top two rows of pushkeys on the Graphics Recorder Type 2313 fitted with the Control Function Overlay SA 0301 belonging to Application Package BZ 7001

In addition, the pushkeys enable different functions and sub-functions to be chosen with the Recorder. These depend on the particular Application Package employed and are printed on a Control Function Overlay included with each package. The Overlay is a small oblong sheet of plastic and fastens between the catches on either side of the keys as indicated in Fig.2.2.

For operation with Application Package BZ 7001 the appropriate Control Function Overlay is SA 0301. Functions and sub-functions selectable using a single key stroke are indicated directly on the overlay and are headed by plain and cursive text respectively to help distinguish between them. Generally, functions are used to specify a destination (**Plot** spectra, for example) and may be selected when the **Active LED** beside the pushkeys is lit (see section 4.2), while sub-functions are used to specify a data source (**2131**, for example) and may be chosen following selection of a function when the **Entering LED** is lit (see section 4.3).

Functions selectable using a single key stroke, are as follows:

List [0]
or
Plot [1]:
Generate hard-copy alphanumeric listing or fully annotated graphic plot of measurement displayed on the 2131, or one already processed or stored using the 2313 plus BZ 7001. See sections 4.2.1 and 4.2.2 respectively.

Move to Memory [2]
or
Move to C. Memory [3]:
Store measurement from the 2131 (or one already processed or stored using the 2313) in a volatile or continuous memory file of the Recorder. See sections 4.2.3 and 4.2.4 respectively.

Move to 7400 [4]:
Stores measurement from the 2131 (or one already processed or stored using the 2313) in a tape file on the 7400 Digital Cassette Recorder. See section 4.2.5.

Move to 2131 [5]:
Sets the 2131 for display of a measurement processed or stored using the 2313. See section 4.2.6.

Delete [6]:
Deletes measurement data stored in any one or group of non delete-secured memory files of the 2313, or all files of a non write-protected tape cassette on the 7400. See section 4.2.7.

Memory Menu [7]:
Produces short-form contents list of any one or group of memory files of the 2313, or of a tape file selected on the 7400. See section 4.2.8.

Plot Spectra [8]: Produces multiple grey-tone plot of up to 40 separate measurements of the same type. Facilitates three-parameter mapping of non stationary signals as a function of amplitude, frequency and time. See section 4.2.9.

Record Spectra [9]: Inputs a series of measurements from the 2131, storing them in consecutive volatile memory files of the 2313. May be used together with the internal trigger and wait functions for recording of non stationary signals plus automatic switching of an external sound source for recording reverberation spectra. See section 4.2.10.

Modify Spectrum [–]: Transfers a measurement stored in the 2313 to the display screen of the 2131, enabling it to be modified via the front panel pushkeys of the Recorder. See section 4.2.11.

Modify Cursor [ ]: Moves frequency cursor of the 2131, enabling the amplitude of one or more frequency bands of a stored measurement displayed on the Analyzer to be altered using the **Modify Spectrum** function of the 2313. See section 4.2.11.

Sub-functions which may be selected using a single key stroke when the **Entering LED** is lit, are:

***Simult* [0]:** A sub-function of **Plot** for documenting any two 1/1 or 1/3 octave spectra, reverberation or decay measurements of the same type, which are stored in the volatile memory of the 2313. See section 4.3.6.

Last* [1]:** Selects ***last memory as the data source for repeating the previous operating function entered or performing a new function using previous data. See section 4.3.1.

***Memory* [2]:** Selects the volatile memory as the data source for documenting, storing, deleting or modifying stored measurements depending on the particular destination or function selected.

***C. Memory* [3]:** Selects the continuous memory as the data source for documenting, storing, deleting or modifying stored measurements depending on the particular destination or function selected.

7400* [4]:** Selects the 7400 Digital Cassette Recorder as the data source for documenting, storing or deleting tape recorded measurements provided that these have been previously processed by BZ 7001. See also ***7400 File to BZ 7001 File and section 4.3.10.

***2131* [5]:** Selects the 2131 Digital Frequency Analyzer as the data source for documenting or storing a measurement displayed on the 2131.

***1/12 Oct* [6]:** Sub-function selecting 4-pass, 1/12 octave analysis of a signal measured with the 2131. See section 4.3.2.

***Average* [7]:** Sub-function for averaging of two or more 1/1 or 1/3 octave spectra, reverberation or decay measurements of the same type, which are stored in consecutive memory files of the 2313. Either arithmetic averaging or averaging in dB form may be selected. See section 4.3.3.

***Deviation* [8]:** Sub-function for determining the standard amplitude deviation of two or more 1/1 or 1/3 octave spectra, reverberation or decay measurements of the same type, which are stored in consecutive volatile memory files of the 2313. See section 4.3.4.

Decay* [9]:** Sub-function for recording up to 160 separate measurements from any preselected 1/1 or 1/3 octave frequency band of the 2131. Results are stored as a single file in the ***last memory and are useful in investigation of the rise or decay of non stationary signals. See section 4.3.5.

***Reverb* [–]:** Sub-function for determination of reverberation time as a function of frequency. Measurement is based on a series of 1/1 or 1/3 octave measurements which have been recorded and stored in consecutive volatile memory files of the 2313 using the **Record Spectra** function. See section 4.3.7.

Due to limited space certain functions and sub-functions are not indicated on the Overlay. These are chosen using two or more separate key strokes as indicated below. Functions making use of the **Extension [/]** key are termed extended functions and like the main functions may be selected when the **Active LED** is lit. See in section 4.4.

***Add Spectra* [23]**
or
***Sub. Spectra* [22]:** Add or subtract any two 1/3 or 1/1 octave spectra, reverberation or decay measurements of the same type, stored in the volatile memory of the 2313. See sections 4.3.8 and 4.3.9.

7400 File to
***BZ 7001 File* [24]:** Selects the 7400 as the data source for conversion of tape recorded measurements which have not been previously processed by the 2313. Permits tape recorded measurements recorded directly from the output of the 2131 to be processed and documented by the 2313. See section 4.3.10.

Trigger [/] [3]: Function for automatic activation of **Record Spectra**, in accordance with the trigger conditions (level-time-frequency) selectable via the internal Operating Set-Ups of the 2313. May also be used in conjunction with the **Enter Sequence** function. See sections 4.2.10 and 4.4.1.

Multi Add [/] [33]:
or
Multi Sub. [/] [32]: Add or subtract a 1/3 or 1/1 octave spectrum, reverberation or decay measurement from a series of measurements of the same type stored in consecutive volatile memory files of the 2313. See section 4.4.2.

Personal Text [/] [100]: Permits entry of up to five lines of personal text in the control heading of measurements documented with the 2313. Text is stored in the continuous memory of the Recorder and is entered in ASCII coded form via the front panel pushkeys or over the IEC/IEEE or RS-232C **Interface** on the rear panel. See section 4.4.3, 6.6.13 and 7.1.2 respectively.

Execute 7400 Program [/] [101]: Stores and/or activates a soft-function in a special volatile memory file of the 2313. Soft-functions are available in Digital Tape Cassette form for replay with the 7400 and extend the choice of measurement functions available with the 2313. See section 4.4.4.

Store 7400 Program [/] [102]: Initiates storage in a 7400 tape file of soft-function stored in the volatile memory of the 2313. Permits work-copy to be made of B&K Soft-Function Tape Cassettes. See section 4.4.5.

Enter Sequence [/] [104]: Stores a 100-step user-defined control sequence made up of different measurement, storage and documentation functions selectable with the front panel pushkeys. The sequence is stored in a specially allocated continuous memory file and is automatically deleted when **Enter Sequence** is selected for recording a new sequence. See section 4.4.7.

Execute Sequence [/] [103]: Activates 100-step key push sequence stored using the **Enter Sequence** function of the 2313. Permits a whole series of measurement, storage and documentation functions to be carried out fully automatically. See section 4.4.6.

Edit Sequence [/] [105]: Selects 100-step key push sequence enabling it to be updated without first deleting the entire sequence. See section 4.4.8.

Shift Function [/] [106]: Updates control parameters recorded with the **Enter Sequence** function. Permits automatic stepping of centre frequency band, file no. etc. See section 4.4.9.

Wait [/] [107]: Delays activation of one or more functions of a stored control sequence by a multiple of the entered time. Is used in conjunction with the **Enter Sequence** function. See section 4.4.10.

Wait Clock [/] [108]: Similar to **Wait** except that activation of a stored control function is delayed until the built-in clock corresponds with entered time (Hour-/Minute/second). See section 4.4.11.

Relay On [/] [110] and **Relay Off [/] [111]:** Permit remote switching of an external sound source, audible alarm etc., connected via the **Remote Control** socket on the rear panel of the 2313. They may be used inconjunction with the **Enter Sequence** for automatic execution of a measurement sequence. See sections 4.4.12.

Also available with BZ 7001 is the following common function which is selectable via the internal Operating Set-Ups of the Recorder.

Add Lin. and "A"-Weight: Adds "Linear – 2 Hz to 22 kHz" and "A"-Weight channels to a 1/1, 1/3 or 1/12 octave spectrum recorded with the 2313. See section 4.5.1.

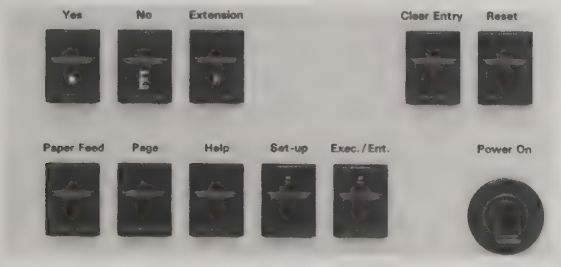


Fig. 2.3. Bottom two rows of pushkeys on the Graphics Recorder Type 2313

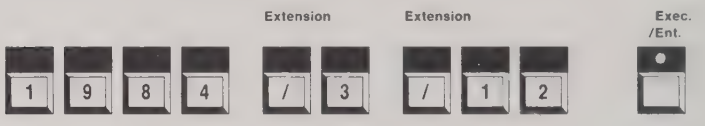
In Fig. 2.3 are shown the remaining pushkeys of the Recorder. These provide the functions described below and are not related to the particular Application Package employed.

Yes [.]
and
No [E]:

For user communication and setting up of parameters with the Set-Up and Clock mode of the Recorder. The decimal point **[.]** and exponential **[E]** are secondary functions and are used when entering numerical data.

Extension [/]:

Extends the choice of functions available with the top two rows of pushkeys. Is also used to separate functions, parameters and numerical data etc., in order that they may be entered as a single string instead of individually. e.g.



Clear Entry:

Deletes last command or numerical data entered using top two rows of pushkeys. Permits false entry to be corrected prior to activating **Exec./Ent.**

Reset:

Terminates selected function returning the Recorder to normal standby status. See section 3.8.1 for other types of reset available.

Paper Feed:

Advances paper as long as pushkey is held depressed. If **Exec./Ent.** is activated while **Paper Feed** is held depressed an automatic self-test is initiated. See section 3.8.2.

Page:

Advances paper the remainder of one full Metric or English page depending on the setting of the **Address Switch** on the rear panel.

Help:

Activates print-out of short-form data and instructions to aid entry of commands and other data via the front panel pushkeys.

Set-Up:

On-Off key, which initates the setting up procedure for the different forms of read-out. The built-in LED of the key lights when the Set-Up procedure is activated. See section 3.9.

Exec./Ent:

Executes a command or terminates entry of data via the front panel pushkeys. The built-in LED of the key lights when **Exec./Ent.** is activated and command execution is in progress. Pressing **Exec./Ent.** immediately after a function has been executed will repeat the function and where pertinent will automatically update memory and tape file parameters etc. See introduction of section 4.2.

Active LED:

Lights when the Recorder is used as a system controller (e.g. **Address Switch** set to "System Controller Active"), and data is not being entered. Indicates that the Recorder is ready to accept a function via the front panel pushkeys of the instrument.

Talk LED:

Lights when the Recorder is sending data over the IEC Interface.

Listen LED:

Lights when the Recorder is receiving data over the IEC Interface.

Control LED:

Lights when the Recorder is sending IEC control commands over the IEC Interface.

Entering LED: Lights when the Recorder is ready to accept numerical data entered via the front panel pushkeys of the instrument or sent over the IEC Interface.

2.2. REAR PANEL

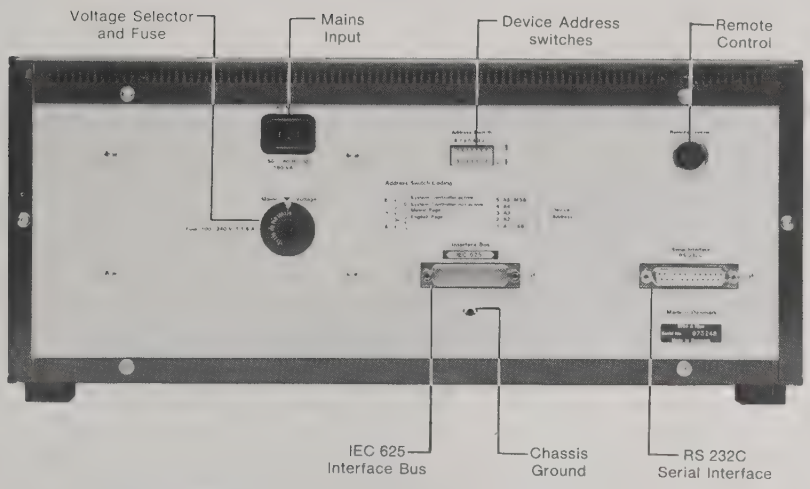


Fig. 2.4. Rear panel of the Graphics Recorder Type 2313

Address Switch: A set of eight miniature two-position rocker switches for manual selection of device address number with the digital interface bus of the 2313, plus selection of "System controller Active" or "Not Active" and "Metric" or "English" page length. On delivery the **Address Switch** numbers A5 to A1 are set to "00001" (ie., device address number 1). See sections 4.1. and 6.3.

IEC 625 Interface Bus: 25-pin connector conforming to IEC 625-1. Is for digital input and output of measurement data plus remote control of the measurement and recording system via a IEC 625-1 or IEEE std. 488 digital interface bus. See section 6.1 for appropriate interface cable.

RS 232C Serial Interface: 25-pin connector for digital input of personal text plus remote setting of the front panel pushkeys and operating set-ups of the Recorder via the keyboard of an RS 232C terminal. See Chapter 7.

Remote Control: 8-pin socket accepting the standard DIN plug (B&K no.JP 0802) with screw-lock provided. Permits remote switching of an external sound source such as the B&K Type 4224 using the internal relay in conjunction with the **Record Spectra** and **Relay On – Off** functions of BZ 7001 (see sections 4.2.10 and 4.4.12). The relay has a maximum contact rating of 0,25 A, 200 V and 3 W respectively, and is connected with the **Remote Control** socket as indicated in Fig.2.5.

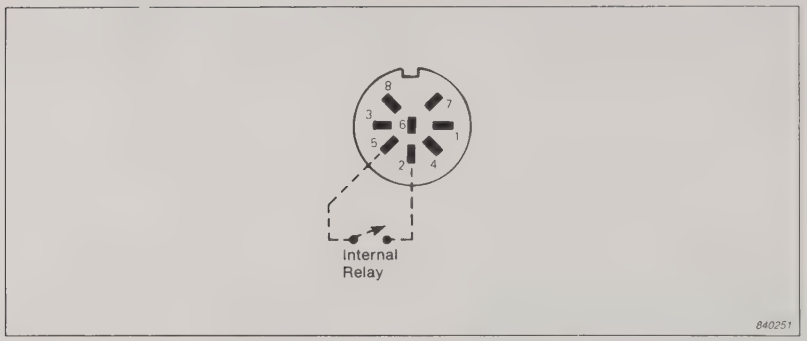


Fig. 2.5. External pin identities of the Remote Control socket of the 2313. In the standby condition (Relay Off) pins 2 and 5 of the socket are interconnected internally

Voltage Selector and Fuse:

Voltage selector for operation from a 100; 115; 127; 200; 220 or 240 V AC mains supply. The selector also contains a slow blow mains fuse. To select the appropriate voltage setting and fit the correct fuse, see section 3.3.

Mains Input:

2-pin socket accepting the Power Cable AN 0020 provided for connection of an AC mains supply. Before connecting a supply, the mains voltage setting and fuse checks given in section 3.3 should be carried out to ensure safe operation of the instrument.

3. PRELIMINARY

3.1. ENVIRONMENT AND HANDLING

The Graphics Recorder Type 2313 is designed for indoor use at temperatures from +10 to +40°C (+50 to +104°F) and humidities up to 90% RH (non-condensing) at 30°C. For safe operation avoid use in volatile environments and before each use of the instrument check that it is set to match the available supply voltage as described in section 3.1.3.

To ensure reliable operation, it is important that the following be observed:

- When first using the 2313 keep it powered for approximately 14 hours to prevent loss of data stored in its continuous memory.
- If the 2313 is not to be used for 4 weeks or more, disconnect the internal Ni-Cd battery used to power its continuous memory (see section 3.4).
- For optimal reproduction of printed data regularly clean the print head as described in section 3.7. Avoid use of chemical cleaning agents and sharp tools, as these can damage the head.

3.2. BENCH AND RACK MOUNTING

The 2313 may be used free-standing on its four plastic feet or, with the addition of the Flanges KS 0024 available, may be mounted in a 19 inch instrumentation rack. The flanges fasten via two screw holes at the front of the instrument side panels. These are accessible on easing back the bottom panel fastened by two screws on the rear of the instrument, and withdrawing the plastic corner plus grooved plastic strips at the front of the side panels. Before releasing the bottom panel ensure that 2313 is disconnected from the mains supply.

3.3. CONNECTION OF MAINS SUPPLY

Before connecting a mains supply, the following mains voltage setting and fuse checks should be carried out to ensure safe operation of the instrument.

Mains Voltage Setting:

The 2313 may be powered from 100, 115, 127, 200, 220 and 240 V ±10% (50 to 60 Hz) single phase AC mains lines. To select the correct mains voltage setting, use a small screwdriver to push in and release the fuse holder at the centre of the **Mains Voltage Selector** on the rear panel. Pull the fuse holder straight out and using a small coin or wide-blade screwdriver turn the selector disc so that the appropriate voltage setting lines up with the black arrow printed on the panel.

Fuse Rating:

To check or replace the mains fuse, release and withdraw the fuse holder at the centre of the **Voltage Selector**. For operation from 100 to 240 V AC supplies the fuse should be a 1,6 A slow blow (B & K no. VF 0007). Make sure that only fuses with the required rated current and of the specified type are used for replacement. The use of mended fuses and the short circuiting of fuse holders should be avoided.

Supply Connections:

Once the mains voltage setting and fuse have been checked, the mains supply may be connected to the **Mains Input** socket of the 2313 using the Power Cable AN 0020 supplied. The 2313 has a high standard of safety insulation in accordance with safety class II of IEC 348 and therefore its chassis need not be connected to mains ground.

3.4. CONNECTION OF CONTINUOUS MEMORY SUPPLY

Both the continuous memory and built-in clock of the 2313 are powered by a rechargeable Ni-Cd battery. As standard this is supplied already wired in the 2313, but to avoid unnecessary power drain during storage and shipment is internally disconnected from the instrument.

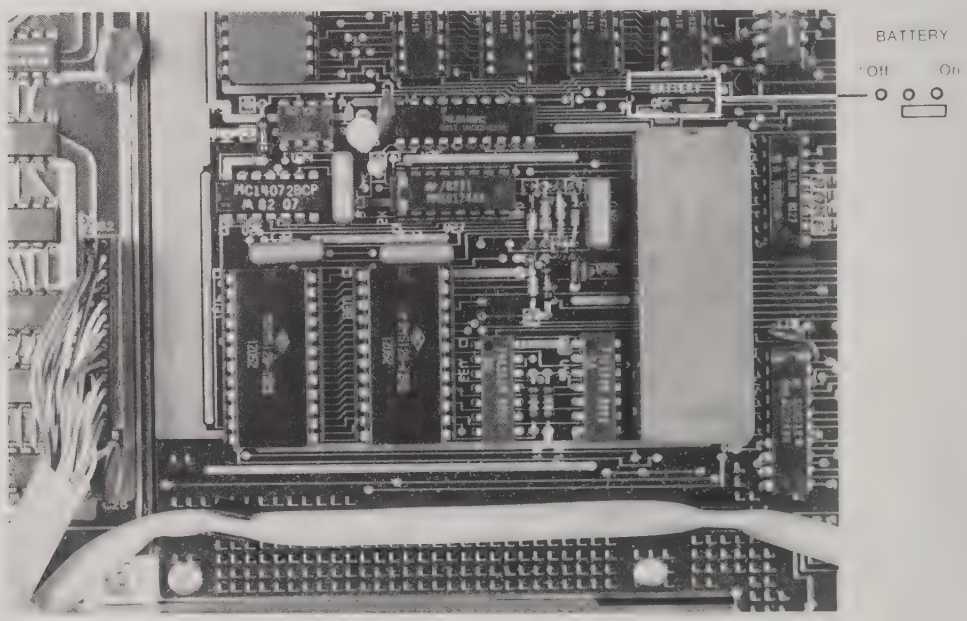


Fig. 3.1. Contact clip for connecting and disconnecting the internal Ni-Cd battery used for powering the continuous memory and clock of the 2313

To connect the Ni-Cd battery, disconnect the mains supply from the 2313 and remove its top panel which is fastened by two screws on the rear of the cabinet. The battery is located on the main circuit board on the base of the instrument. It may be connected by sliding off the contact clip from the group of three pins shown in Fig. 3.1 and using it to connect the centre pin and pin marked "On".

For recharging the Ni-Cd battery, the 2313 has its own charging circuit built-in. This is operative as long as the 2313 is operated from a mains supply and keeps the continuous memory powered more or less indefinitely provided that the 2313 is subjected to approximately 30 minutes use each day, 3,5 hours use each week or 14 hours use every 4 weeks. However, when using the 2313 for the first time it should be kept powered for at least 14 hours to ensure that the battery attains full charge capacity.

WARNING! To prevent damage to the battery ensure that it is regularly charged. If the 2313 is not to be used for more than 4 weeks, recharge the battery for approximately 14 hours and disconnect it as described above.

3.5. GROUNDING CONSIDERATIONS

Indiscriminate grounding of instruments can introduce ground loop interference. To prevent this influencing the measuring and analyzing instruments with which the 2313 is used it is important that the signal and digital ground lines of the instruments are grounded at one point only in the measurement system. To do this without prejudicing the operating safety of the instruments, proceed as follows:

1. Connect the signal ground lines of all instruments together. This is done automatically through the screens of the input and output cables used to interconnect the instruments.

2. Where the same instruments are interconnected by more than one signal cable or combination of signal and remote control cables each containing a signal ground connection, keep the cables short and close together or disconnect the signal ground line of all but one of them.

3. Where instruments are interconnected by a digital interface cable containing a chassis ground connection, check that one and only one of these instruments has its signal ground or digital ground connected to chassis.

4. Where the measurement arrangement is used free-standing without the instrument cabinets touching, check that each of the other instruments in the measurement arrangement has its chassis connected to a) mains ground only or b) signal ground or digital ground only. With instruments equipped with a mains connector having a protective earth-chassis contact, a) is to be preferred.

5. Where the measurement arrangement is mounted in an instrumentation rack, ensure that one and only one of the instruments has its signal ground or digital ground connected to chassis (and chassis connected to mains ground if equipped with a mains connector having a protective earth - chassis contact). If more than one of the instruments has a permanent signal ground - chassis connection, then isolate the cabinets of these instruments from the rack.

6. Finally, where the signal ground line is connected to mains ground via the mains connector of one of the instruments, isolate the housing of the measurement transducer from grounded measurement sources.

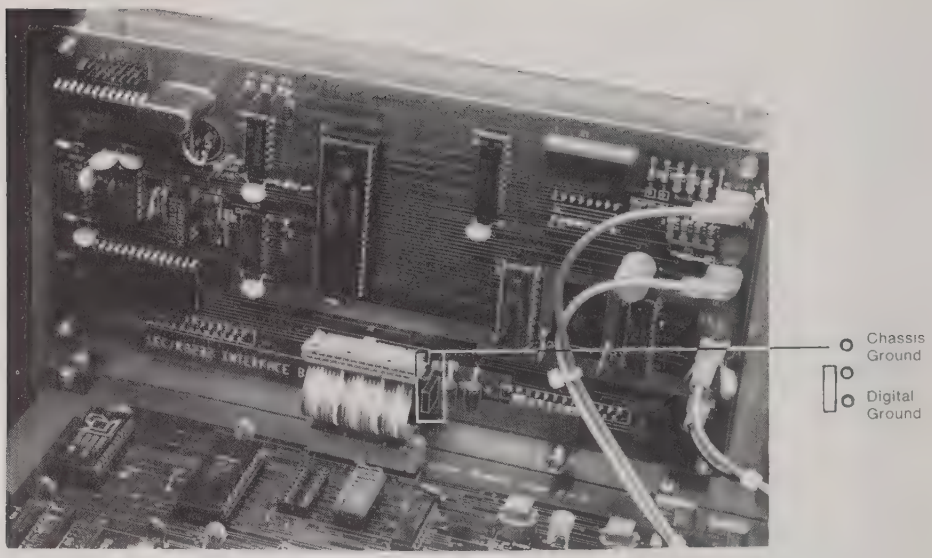


Fig. 3.2. The Digital and Chassis Ground contacts of the 2313

As standard the 2313 is delivered with its digital ground connected to chassis, which is that normally required for operation in most instrument set-ups. However, where the above grounding requirements dictate otherwise, they may be disconnected from one another by carefully easing off the contact clip from the interface board contacts shown in Fig. 3.2 and using it to connect the top and middle contacts indicated. The interface board is mounted on the rear panel and is accessible on sliding off the top panel which is fastened by two screws at the back of the instrument. Before removing the top panel ensure that 2313 is disconnected from the mains supply.

WARNING! The 2313 is designed to be operated with its digital ground and chassis at zero earth potential. Never let the signal ground terminals, socket screens or chassis float at other than approximately zero earth potential, as this will impair the operating safety of the apparatus and may damage it.

3.6. INSTALLATION OF APPLICATION PACKAGE

Application Package BZ 7001 especially converts the 2313 for documenting, storage and processing of measurement data transmitted by the B&K Digital Frequency Analyzers Types 2131 and 3360. In addition it permits use of a Digital Cassette Recorder Type 7400, thus enabling tape recorded measurements to be handled, provided that these originate from either the 2131 or 3360. For operation with other B&K measurement and analysis equipment, one of the other Application Packages available for the 2313 should be employed. See Chapter 1.

Before replacing an Application Package with BZ 7001, the contents of the continuous and volatile memories of the 2313 should be checked using the **Memory Menu** function (see section 4.2.8). If important data from previous measurements is present, then it should be recorded on tape as described in section 4.2.5. This is necessary as stored data will be automatically deleted when BZ 7001 or another Package is fitted.

Having carried out the above check, the Application Package may be replaced by BZ 7001. To do this set the **Power On** switch of the 2313 to "Off", unscrew the captive fastening on the front of the Package and use this to pull the Package out of the

Recorder. BZ 7001 may then be inserted and its Control Function Overlay SA 0301 clipped over the top row of pushkeys on the front panel as indicated in Fig. 3.3. For protection from dust and other foreign matter never leave the Recorder without a Package fitted and store Packages not in use in their mahogany case together with their Control Function Overlay.

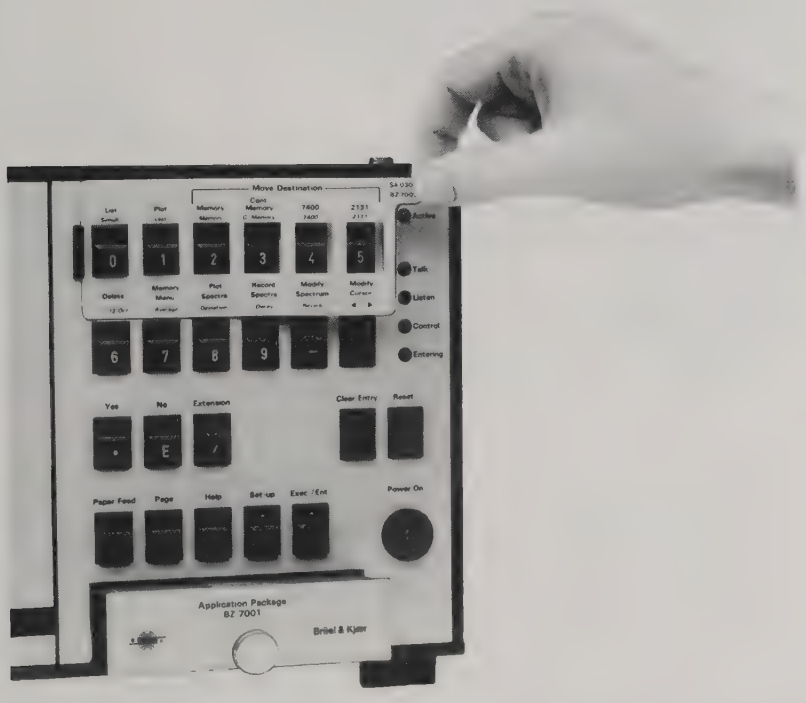


Fig. 3.3. Fitment of Application Package and Control Function Overlay

3.7. PAPER LOADING AND CLEANING OF THE PRINT HEAD

To load the 2313 with a fresh roll of Paper QP 4690, proceed as follows:

1. Press down the **Release Catch** on the front panel and pull forward the paper drive frame as shown in Fig. 3.4.

2. Lower the **Release Arm** on the left of the drive frame and lift out the paper spindle together with the remainder of the old paper roll if one is fitted.

3. Wipe a soft lint-free cloth along the rear of the print head to remove traces of print dust which may have accummulated during previous use. See Fig. 3.5.

4. Slide a fresh roll of Paper QP 4690 onto the paper spindle and hold it just in front of the drive frame as shown in Fig. 3.4.

5. Push each end of the paper spindle into the empty **Take-Up Slots** on either side of the drive frame and check that the spindle clips fast on the ball-catches in the slots.

6. Remove the adhesive label and pull out approximately 30 cm (12 in) of paper from the roll.

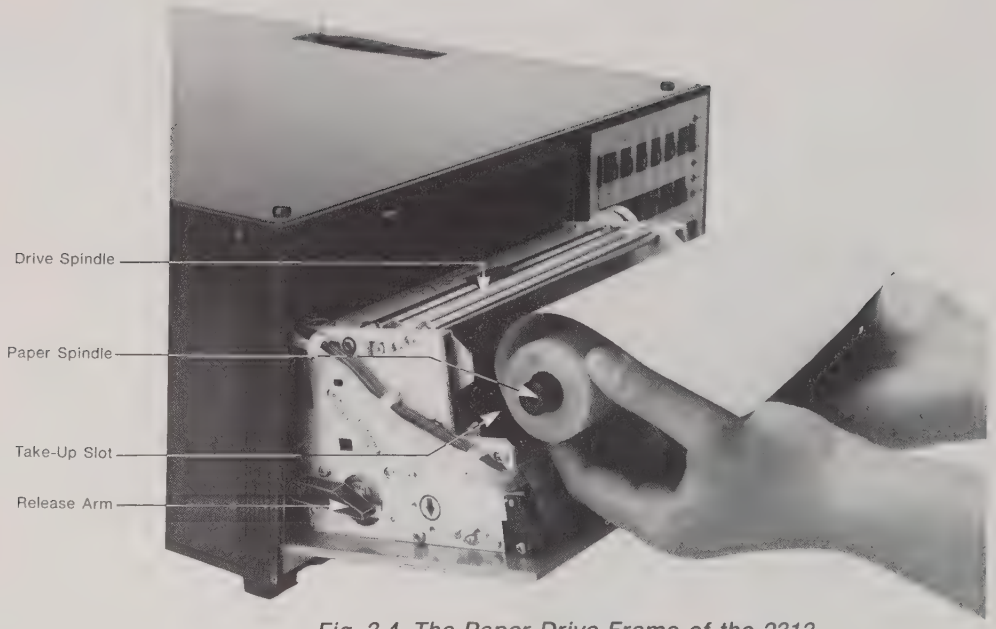


Fig. 3.4. The Paper Drive Frame of the 2313

7. Carefully feed the free end of the paper between the guide and drive spindles until it protrudes from the opening on the front panel of the drive frame.

8. Lightly pull the free end of the paper to take up any slackness and raise the **Release Arm** on the left of the drive frame to lock the pressure spindle.

9. Hinge up the front of the drive frame so that it is flush with the front panel of the 2313 and push the **Release Catch** up to lock.

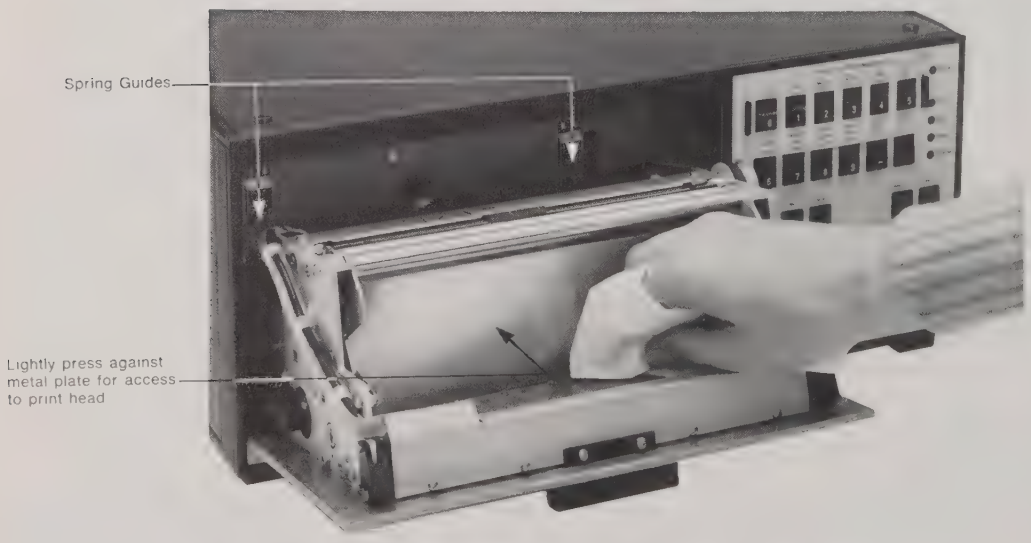


Fig. 3.5. Cleaning the Print Head of the 2313

After loading a fresh roll of recording paper it is recommended that the Self-Test mode of the 2313 be activated as outlined in section 3.8.2. Provided that Recorder is functioning correctly it should generate an exact replica of the test print shown in Fig.3.6.

Should the test print show signs of uneven printing or lack contrast, then it is likely that there are more firmly embedded traces of print dust on the print head. These may be removed by lightly brushing with a soft bristled tooth brush and wiping with a lint-free cloth as shown in Fig. 3.5. For access to the print head repeat items 1 and 2 above and gently press the metal plate at the rear of the writing system to move it 1 or 2 mm away from the head.

If during operation the paper starts to crease at either its left or right-hand edges, then it is likely that the spring guides at the rear of the writing system compartment require realignment (see Fig. 3.5). Normally this is not a frequent occurence and can easily be rectified by gripping the bottom of the guide nearest the faulty edge of the paper and bending it out slightly so that it makes proper contact with the paper when the writing system is folded back into the Recorder.

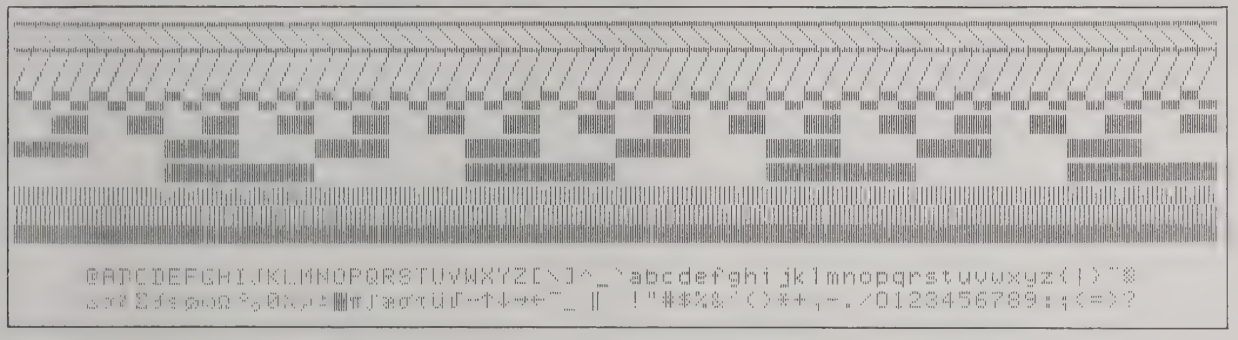


Fig. 3.6. Test print obtained using the self-test mode of the 2313

3.8. USE OF RESET AND AUTOMATIC SELF–TEST

3.8.1. Reset

The **Reset** pushkey is useful for quickly terminating execution of a control function following choice of an incorrect function or one that is not self terminating. In such circumstances, pressing the **Reset** key will return the 2313 to normal standby status where selection of a new function is possible.

Another use of the **Reset** pushkey is in ensuring that the 2313 always selects the appropriate control mode following alteration of its **Address Switch**. In addition, it is capable of restoring normal operation of the Recorder when this has been blocked by a minor malfunction or mains interference. However, whether this use of the **Reset** key is successful or not depends on type of disturbance. If not successful, normal operation can usually be restored by selecting **Power Off** for a couple of seconds and then selecting **Power On**. This has the effect of performing a *power on reset*, which returns the 2313 to its initial power on status, deleting measurement data stored in its volatile memory. If desired a *power on reset* can be performed as part of Self-Test, which is described in section 3.8.2.

A further means of restoring normal operation is by pressing the **Paper Feed** pushkey and whilst keeping it pressed, momentarily pressing **Reset**. This performs a *hard reset* which resets the entire instrument including its built-in clock, plus deletes all measurement data in its volatile and continuous memories. A *hard reset* should therefore only be performed after having tried the other methods of reset described.

If the 2313 fails to respond correctly to a *hard reset*, then it is likely that a more serious fault has occurred. To check the Recorder plus the Application Package the Self-Test mode discussed in section 3.8.2 can be employed.

3.8.2. Automatic Self-Test

For checking the correct function of the 2313, it is equipped with a Self-Test mode. This may be activated in two ways, the simplest of which is by pressing the extreme right-hand key in the second from top row of pushkeys and while keeping it depressed, momentarily pressing **Reset**. The 2313 then starts the test cycle described below and on completion of the tests performs a *power on reset* which returns it to normal power on status plus deletes measurement data stored in its volatile memory.

Where it is important that stored data not be deleted, Self-Test can be activated to provide a print out of a test chart instead. This is provided at the start of the test cycle and is useful in checking the writing system of the Recorder (see section 3.7). It is chosen by pressing the **Paper Feed** pushkey and while keeping it depressed, pressing **Exec./Ent.** However, first it is important that the "System Controller Active" mode be selected by setting **Address Switch** pair number 8 on the rear panel to "1" (see Fig. 4.2.) and pressing the **Reset** pushkey.

Having carried out the above, the Self-Test mode lights all five control LEDs in the top right corner of the front panel and proceeds to check the electronic circuitry of the Recorder and Application Package. On satisfactorily completing each check it automatically extinguishes the relevant control LED. It then continues with the next check until finally only the **Active LED** remains lit, indicating that the test sequence is completed and that the Recorder has returned to normal operating status.

Provided that the 2313 is functioning correctly, the entire test sequence takes approximately 75 seconds to carry out. If, however, a fault is detected then the test sequence will be permanently interrupted. At the same time the relevant control LED for the test plus those yet to be completed will flash, warning that a fault is present.

Where Self-Test is automatically interrupted and only the **Entering** and **Control LED**s remain extinguished, then it is likely that only the Application Package is at fault. To check whether this is the case, reactivate Self-Test with another Package fitted. For repair, please contact your local B&K service representative. Under no circumstances should repair be attempted by persons not qualified in the service of electronic equipment.

3.9. USE OF OPERATING SET-UPS

Following installation of an Application Package BZ 7001 and a roll of Recording Paper QP 4690, one may proceed directly with operation as described in Chapter 4. However, to make full use of the complete range of documentation, storage and measurement functions available with BZ 7001, plus ensure correct read out of date, time etc., it is necessary to develop a basic understanding of the **Set-Up** mode of the Recorder.

The **Set-Up** mode is selected using the key of the same name in the bottom row of pushkeys of the Recorder. As indicated in Fig.3.7 it provides access to the "Select Set-Up", "Set Function", "Set Parameter" and "Set Clock" levels of the Recorder, the use of which are briefly discussed here and in more detail in the following sections.

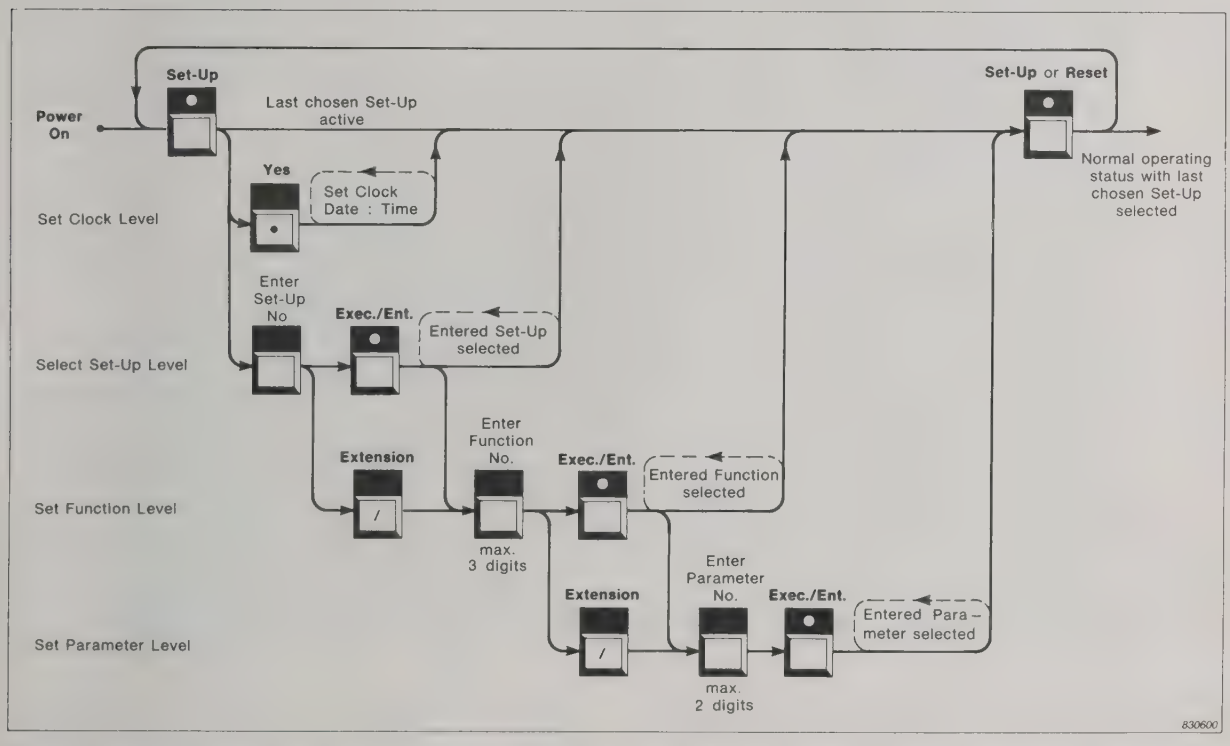


Fig. 3.7. **Set-Up** *mode key push sequences for selecting the Set Clock, Select Operating Set-Up, Set Function and Parameter levels of the 2313*

With the "Select Set-Up" level any one of four Operating Set-Ups numbered from 0 to 3 may be chosen. Each Set-Up is furnished with the functions and parameters listed in Fig. 3.8 which are individually numbered to permit access via the front panel pushkeys of the Recorder. Whereas the parameter values and units of Set-Up No: 0 are fixed, those of Set-Ups No: 1 to 3 may be changed by the user to suit individual application requirements. The range of values and units which may be set depends on the particular control function the parameters belong and are specified in sections 4.2 to 4.5 respectively.

The individual Set-Ups are stored in the continuous memory of the Recorder and therefore are not affected by disconnecting mains power to the apparatus. If, however, another Application Package is inserted or the charge state of the internal Ni-Cd battery is allowed to fall below that required to power the continuous memory, then Set-Ups No: 1 to 3 will be automatically reset to the corresponding values of the Default Set-Up (i.e.

Operating Set-Up No: 0). Also Operating Set-Up No: 1 will be automatically selected when first powering the instrument, instead of the set-up last chosen during previous use.

SELECTED SETUP NO.: 0

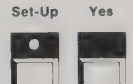
FUNCTION	PARAMETER		VALUE		UNIT
0 List	1 List from	:	0		Hz
0 List	2 List to	:	22000		Hz
0 List	3 Including head	:	YES		
1 Plot	1 Graphic offset	:	0		dB
1 Plot	2 Scale proportion, 25dB/	:	5		cm
1 Plot	3 Plot from	:	0		Hz
1 Plot	4 Plot to	:	22000		Hz
1 Plot	5 Graphic offset	:	0		s
1 Plot	6 Scale proportion, 2.5s/	:	5		cm
2 Memory	1 Store-secured	:	-1	-1	
3 Cont. memory	1 Store-secured	:	-1	-1	
6 Delete	1 Memory secured	:	-1	-1	
6 Delete	1 Cont. memory secured	:	-1	-1	
8 Plot spectra	1 Grid	:	No		
9 Record spectra	1 No. of averages	:	1		
9 Record spectra	2 Source control	:	NO		
9 Record spectra	3 Spectrum sample interval	:	2		* 22ms
9 Record spectra	4 Wait between averages	:	0		s
9 Record spectra	5 Sound build-up	:	2		s
(/ 3) 13 Trig	1 Active	:	NO		
(/ 3) 13 Trig	2 Level	:	0		dB
(/ 3) 13 Trig	3 Time over level	:	0		* 22ms
(/ 3) 13 Trig	4 Decreasing level	:	5		dB
(/ 3) 13 Trig	5 Frequency	:	1000		Hz
(/100) 110 Personal text	1 Enable line 0	:	NO		
(/100) 110 Personal text	2 Enable line 1	:	NO		
(/100) 110 Personal text	3 Enable line 2	:	NO		
(/100) 110 Personal text	4 Enable line 3	:	NO		
(/100) 110 Personal text	5 Enable line 4	:	NO		
SUBFUNCTIONS:					
16 1/12 octave	1 Man. scan	:	NO		
16 1/12 octave	2 Valid low freq. in auto.	:	80		Hz
17 Average	1 Arithmetical	:	YES		
18 Deviation	1 Arithmetical	:	YES		
19 Time decay curve	1 Number of files	:	39		
19 Time decay curve	2 Show reverb. interval	:	No		
21 Reverberation	1 Determination interval	:	-5	-35	dB
22 Sub. spectra	1 Arithmetical	:	YES		
23 Add spectra	1 Arithmetical	:	YES		
COMMON SETUP:					
200 Add Lin and A	1 Lin and A weight channel	:	NO		

OP2313AA0

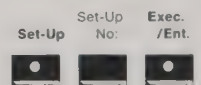
Fig. 3.8. Functions and Parameters available with Operating Set-Up No: 0 (i.e. Default Set-Up) of Application Package BZ 7001

The basic pushkey sequences for selecting the various Set-Up mode levels, are as follows:

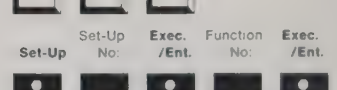
Select Clock:



Select Set-Up:

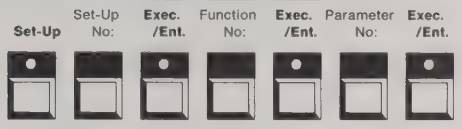


Select Function:

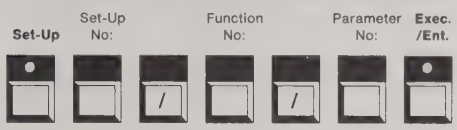


or:

Select Parameter:



or:



further details of which are given in the following sections. If at any stage there is doubt about which Set-Up, Function or Parameter has been entered, or as to which values and units may be entered, press the **Help** key.

3.9.1. Set Clock

For a correct record of date and time at the top of each readout presented by the 2313, the built-in clock of the Recorder must be properly set. This is accomplished as described below and employs the key push sequence shown in Fig. 3.9.

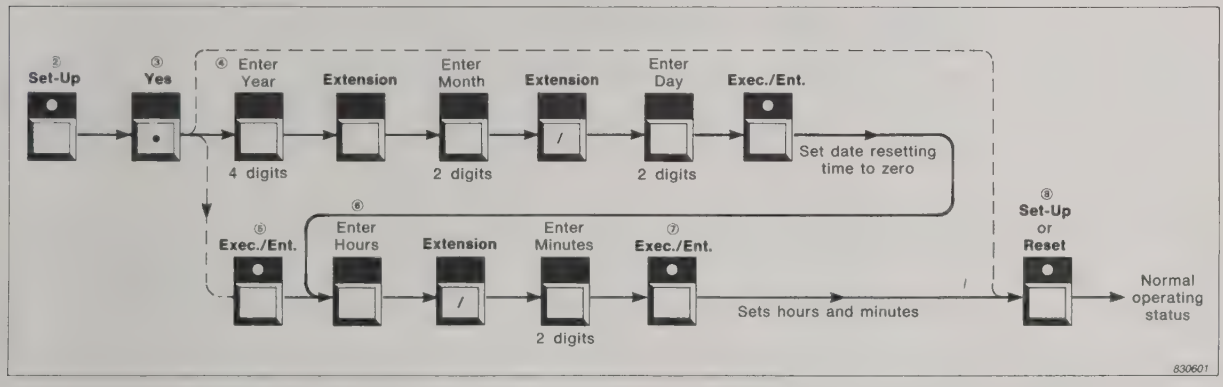


Fig. 3.9. **Set-Up** *mode key push sequence for setting date and time with the 2313*

1. Select **Power On**. Either the **Active** or **Entering LED** will light, and the date and time set with the internal clock printed. e.g.

```
DATE: 1984-03-01      TIME: 8:30:16
```

If `CONTINUOUS MEMORY AND CLOCK CLEARED` and/or `DATE: 9999-01-01` is printed, check that the internal Ni-Cd battery for the continuous memory is connected before proceeding with step 2. See section 3.4.

2. Press **Set-Up** to activate the Set-Up mode plus print the identity of the particular operating set-up selected. At the same time the **Set-Up** and **Entering LEDS** will light and, if previously lit, the **Active LED** extinguished.

```
Setup mode, active setup no: 1
```

3. Press **Yes** to activate the set clock mode, as well as print the date and time currently set.

```
Date: 1984-03-01   Time: 8:33:12   Enter Date
```

If both the date and time are correct, go to step 8 to return the 2313 to its initial operating status.

If only the date is correct, press **Exec./Ent.** and go to step 6 to enter the correct time.

4. For entry of the correct date, key-in **[YEAR] [/] [MONTH] [/] [DAY]** in turn. e.g.

To correct a false entry, press **Clear Entry** to delete, and re-enter the **[YEAR] [/] [MONTH] [/] [DAY]**.

5. Press **Exec./Ent.** to set the clock to the entered date and reset the time to zero.

```
Date: 1984-03-12   Time: 00:00:00   Enter time
```

6. To enter the correct time, key-in **[HOURS] [/]** and **[MINUTES]** one minute ahead of actual time. e.g.

To correct a false entry, press **Clear Entry** to delete, and re-enter **[HOURS] [/] [MINUTES]**.

7. Wait until the actual time corresponds to the value entered and press **Exec./Ent.** to set the clock to the correct time.

```
Date: 1984-03-12   Time: 10:45:00   Enter date
```

If the time set is not quite correct, press **Exec./Ent.** one more time and return to step 6.

8. Once the date and time are accurately set, press **Set-Up** to return the 2313 to normal standby status. The **Set-Up LED** should be extinguished and either the **Active** or **Entering LEDs** relit.

3.9.2. Select Set-Up

The "Select Set-Up Level" of the **Set-Up** mode permits selection of a suitable Operating Set-Up for documenting, storage and processing measurements. In addition it may be used for listing and setting one or more complete set-ups to default. The particular key push sequence employed is as described below and is illustrated in Fig.3.10.

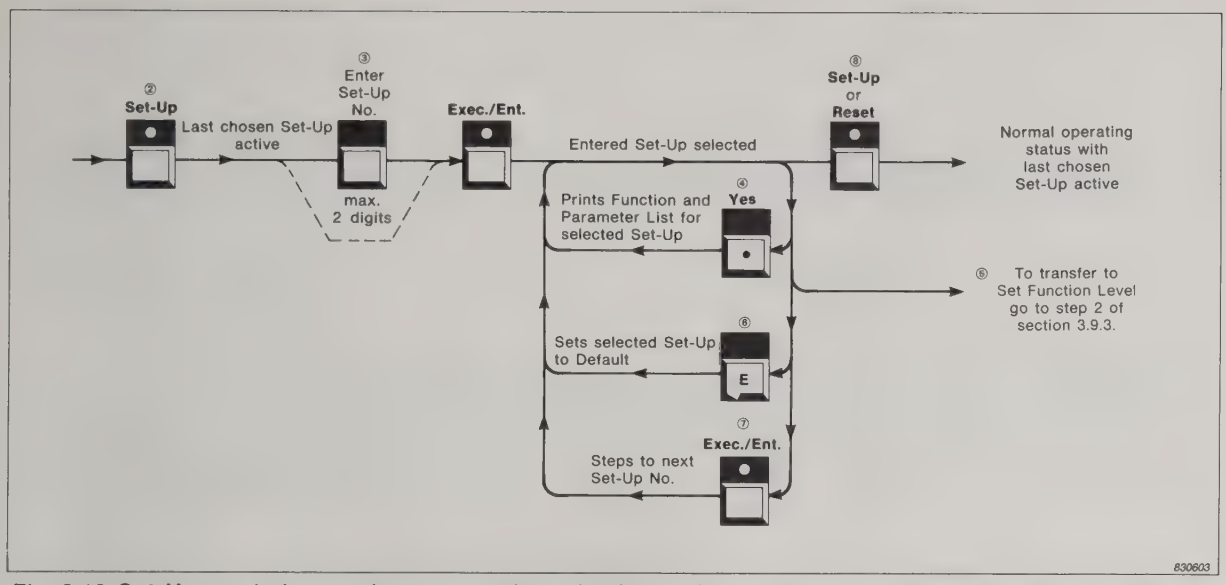

② Set-Up
Last chosen Set-Up active
③ Enter Set-Up No.
max. 2 digits
Exec./Ent.
Entered Set-Up selected
⑧ Set-Up or Reset
Normal operating status with last chosen Set-Up active
④ Yes
Prints Function and Parameter List for selected Set-Up
⑤ To transfer to Set Function Level go to step 2 of section 3.9.3.
⑥ E
Sets selected Set-Up to Default
⑦ Exec./Ent.
Steps to next Set-Up No.
830603

Fig. 3.10. **Set-Up** *mode key push sequence for selecting and listing Operating Set-Ups and setting them to default*

1. Select **Power On**. Either the **Active** or **Entering LED** will light, and the date and time set with the internal clock printed. e.g.

```
DATE: 1984-03-12    TIME: 10:48:16
```

   If `CONTINUOUS MEMORY AND CLOCK CLEARED` and/or `DATE: 9999-01-01` is printed, check that the internal Ni-Cd battery for the continuous memory is connected before proceeding with step 2. See section 3.4.

2. Press **Set-Up** to activate the Set-Up mode plus print the identity of the particular operating set-up selected. At the same time the **Set-Up** and **Entering LEDS** will light and, if previously lit, the **Active LED** extinguished.

```
Setup mode, active setup no: 1
```

3. Enter the number **[0, 1, 2 or 3]** of the particular set-up desired for operation and press **Exec./Ent.** to select the set-up. Alternatively, if the desired set-up is already active, press **Ent./Ent.** only. The identity of the set-up will be printed.

```
SELECTED SETUP NO: 2
```

   Steps 4 to 8 may be carried out at the users discretion.

4. For a complete list of the operating functions, parameters and values set with the chosen set-up (see Fig. 3.8), press **Yes**.

5. To set one or more of the operating functions of the set-up to default or alter the parameters values of a particular function, go to step 2 of section 3.9.3 and 3.9.4 respectively.

6. To set the entire set-up to the default values set with the DEFAULT SET–UP NO: 0, press **[E]**. The following is printed:

```
Selected setup changed to default
```

7. If another set-up is preferred for operation or must be set to default, use the **Exec./Ent.** pushkey to step through each set-up in turn, until the required set-up is selected.

```
SELECTED SETUP NO: 1
SELECTED SETUP NO: 0
SELECTED SETUP NO: 3
```

8. To return the 2313 to normal standby status with the last chosen set-up selected, press **Set-Up** or **Reset**. The **Set-Up LED** should be extinguished and either the **Active** or **Entering LED** relit.

3.9.3. Set Function

The "Set Function Level" of the **Set-Up** mode is useful for listing and setting one or more complete control functions of the different Operating Set-Ups to default. The appropriate key push sequence employed is as described below and is shown in Fig.3.11.

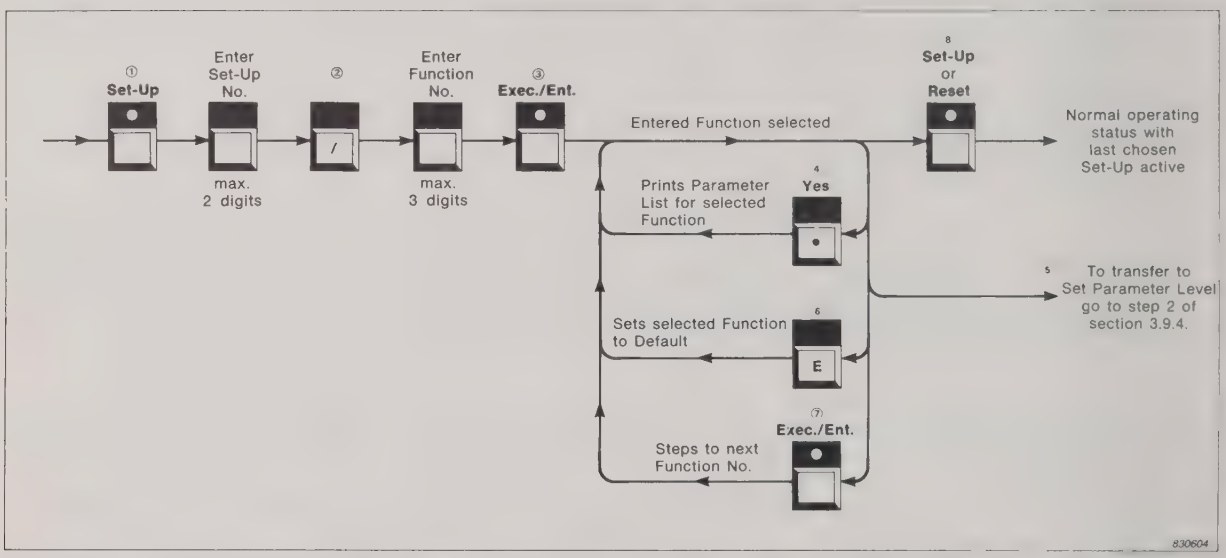


Fig. 3.11. **Set-Up** *mode key push sequence for selecting and listing individual Functions of the Operating Set-Ups, plus setting them to default*

1. Press the **Set-Up** pushkey and enter the number **[0 to 3]** of the particular set-up required for operation, e.g.

2. Press **Extension[/]** and enter the number **[0 to 200]** of the particular operating function of interest, e.g.

Note: If the required set-up has already been selected as in section 3.9.2, then only the **[Function Number]** should be entered.

To correct a false entry, press **Clear Entry** to delete, and re-enter the **[Set-Up Number] [/] [Function Number]**.

3. Press **Exec./Ent.** to select the entered Set-Up and Function, plus print their identity.

```
SELECTED SETUP NO: 1
2 Memory
```

Steps 4 to 8 may be carried out at the users discretion.

4. For a list of the parameter values set with the selected function, press **Yes**.

```
SELECTED SETUP NO: 1

  FUNCTION              PARAMETER                    VALUE          UNIT
2 Memory              1 Store — secured :          —1     —1
```

5. To alter one or more of the parameter values of the function, go to step 2 of section 3.9.4.

6. To set the function to the default values set with the corresponding function of the DEFAULT SET–UP NO: 0, press **[E]**. The following is printed:

```
Selected function changed to default
```

7. If another function must be set to default, use the **Exec./Ent.** pushkey to step through each function in turn, until the required function is selected.

```
8 Plot spectra
6 Delete
3 Cont. memory
```

8. To return the 2313 to normal operation with the above chosen set-up selected, press **Set-Up** or **Reset**. The **Set-Up LED** should be extinguished and either the **Active** or **Entering LED** relit.

3.9.4 Set Parameter and Parameter Value(s)

The "Set Parameter Level" of the **Set-Up** mode is used for selection and alteration of individual control function parameters within the Operating Set-Ups. The values and units to which the parameters may be individually set, depend on the particular control function to which they belong and are as specified in sections 4.2 to 4.5.

1. Press the **Set-Up** pushkey and enter the **[Set-Up Number] [/] [Function Number]** of interest. e.g.

2. Press **Extension[/]** and enter the number **[0 to 6]** of the particular parameter of interest. e.g.

Note: If the required set-up and function have already been selected as in section 3.9.3, then only the **[Parameter Number]** should be entered.

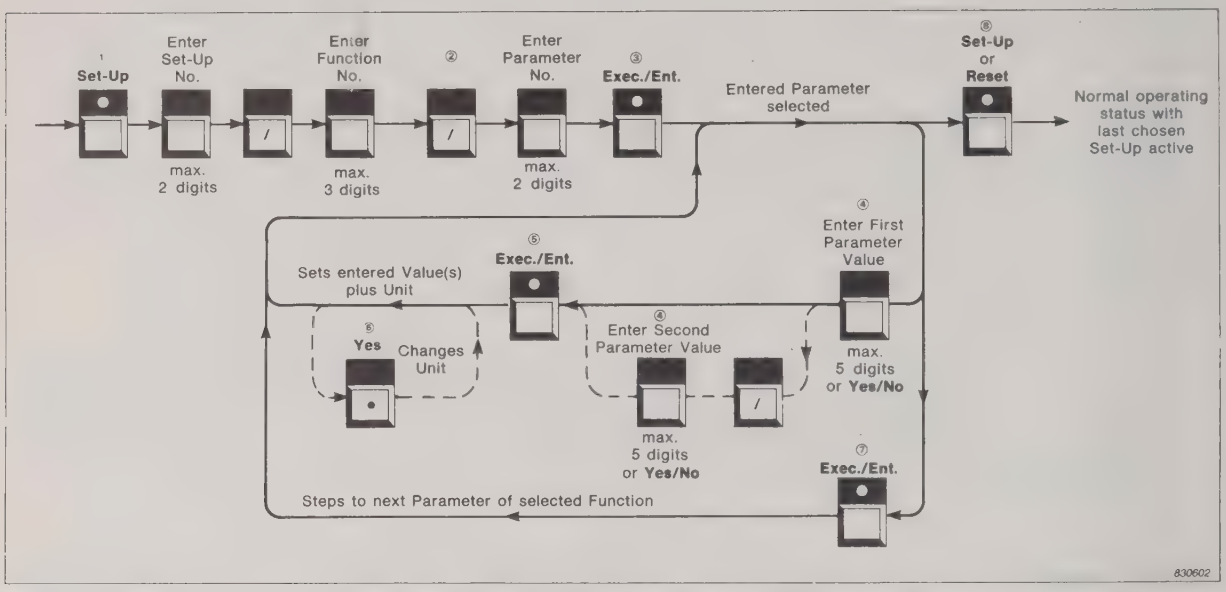


Fig. 3.12. **Set-Up** *mode key push sequence for selecting Operating Set-Ups Parameters, plus changing individual parameter values and units*

To correct a false entry, press **Clear Entry** to delete, and re-enter the **[Set–Up Number] [/] [Function Number] [/] [Parameter Number]**.

3. Press **Exec./Ent.** to select the entered Set-Up, Function and Parameter, plus print their identity.

```
SELECTED SETUP NO: 1
9 Record spectra      4 Spectrum sample interval :      0          * 22ms
```

4. To alter the parameter value, enter the new value (max. 5 digits or logic **Yes**, **No**). With parameters having two separate values, enter **Extension[/]** after the first value to permit entry of the second.

Parameter Value or Parameter Value / Parameter Value

If unsure of which value to enter, press **Help** for a printout of acceptable values (ie. Parameter Value Check) plus details of current entry status. Alternatively, refer to sections 4.2 to 4.5 for the particular function selected.

To correct a false entry, press **Clear Entry** to delete, and re-enter the correct value.

5. Press **Exec./Ent.** to set the value(s) entered, plus obtain a print out confirming the value(s) set:

```
9 Record spectra      4 Spectrum sample interval :      5          * 22ms
```

If an incorrect value is entered, an error warning plus parameter value check will be printed e.g.

```
Parameter value not allowed                                  ERROR NO: 6

PARAMETER VALUE CHECK:
          1 < values < 1000
```

6. To change the parameter value unit (e.g. ms to s, s to min., min. to ms etc.), repeatedly press **Yes** until the required unit is printed, e.g.

```
9 Record spectra     4 Spectrum sample interval :     5          min.
9 Record spectra     4 Spectrum sample interval :     5          s
9 Record spectra     4 Spectrum sample interval :     5          * 22ms
```

7. To step to another parameter of the selected function, ready for entry of new values as in steps 4 to 6, repeatedly press **Exec./Ent.** until the appropriate parameter is printed.

```
9 Record spectra     1 No. of averages           :     0
9 Record spectra     6 Sound build up            :     0          * 22ms
9 Record spectra     5 Wait between averages     :     0          * 22ms
9 Record spectra     4 Spectrum sample interval  :     5          min.
```

8. To select another function and/or parameter within the same set-up, first return to normal operation and then repeat the above procedure.

   To return to normal operation with the above set-up and parameter values selected, press **Set-Up** or **Reset**. The **Set-Up LED** should be extinguished and either the **Active** or **Entering LED** relit.

4. USE WITH DIGITAL FREQUENCY ANALYZER TYPE 2131 PLUS DIGITAL CASSETTE RECORDER TYPE 7400

4.1. BASIC ANALYSIS AND RECORDING SET–UP

The basic instrument set-up for use of the Graphics Recorder Type 2313 plus Application Package BZ 7001 together with the Digital Frequency Analyzer Type 2131 and/or Digital Cassette Recorder Type 7400, is shown in Fig. 4.1. Preparation of the instruments ready for documentation, storage and processing of octave and third octave analyses is as described below.

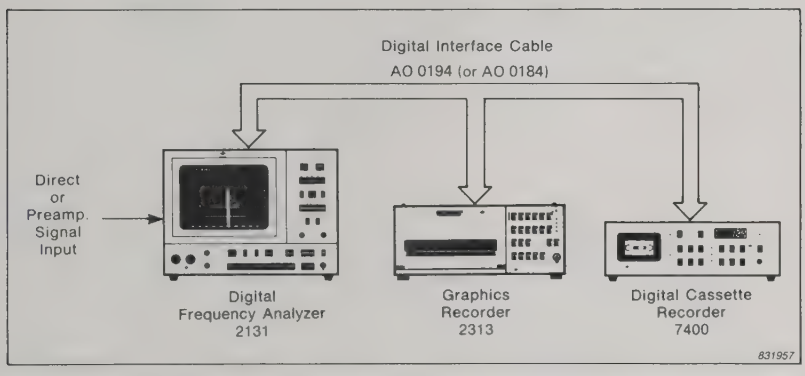


Fig. 4.1. Use of the 2313 Graphics Recorder with the 2131 Digital Frequency Analyzer and 7400 Digital Cassette Recorder

1. Fit the Graphics Recorder with an Application Package BZ 7001, Control Function Overlay SA 0301 and roll of Recording Paper QP 4690. See Chapter 3.

2. Interconnect the **IEC 625 Interface Bus** connectors of the recording and analyzing instrumentation as indicated in Fig. 4.1. If a Digital Cassette Recorder is employed in the set-up, check that its **Interface Mode** switch is set to **"IEC"**. See Introduction of Chapter 6 for details on appropriate interface cable.

3. Check that the "System Controller Active" mode and appropriate "Metric" or "English" chart length are selected with the **Address Switch** pairs **8** and **7** on the rear panel of the Graphics Recorder (see Fig.4.2).

   Similarly, to permit communication with the other instruments in the setup, set **Address Switch** pairs **6** to **2** on the Frequency Analyzer Type 2131 to "11000" and **Multiswitch** pairs **3** to **6** on the Cassette Recorder Type 7400 to "0111".

4. Select **Power On**, and press the **Reset** key on the Graphics Recorder. The 2313 will then print the date and time set with its internal clock, plus light the **Active LED** indicating that it is ready for use as a system controller.

Note: If **CONTINUOUS MEMORY AND CLOCK CLEARED** and/or **DATE: 9999-01-01** is printed, check that the internal Ni-Cd battery for the memory of the Graphics Recorder is connected before proceeding with step 5. See section 3.4.

5. Using the **Set-Up** key of the Recorder, activate the Set-Up mode to set correct date and time with the built-in clock, plus select the particular Operating Set-Up of interest for processing measurements. See section 3.9.

6. Apply the signal to be analyzed and set the puskeys of the Analyzer to produce a suitable octave or third octave frequency spectrum of the signal on the display screen instrument.

7. Fit the Digital Cassette Recorder with a Tape Cassette ready for recording and/or replay of measurements from the Digital Frequency Analyzer Type 2131.

The measurement set-up is now ready for use with the IEC interface and front panel pushkeys of the Graphics Recorder exercising full control over the other instruments in the setup. The relevant pushkey commands used for transfer of measurement data from one instrument to another, plus details on the different control functions used for documenting, storage and reformatting of measurements are given in sections 4.2 to 4.5.

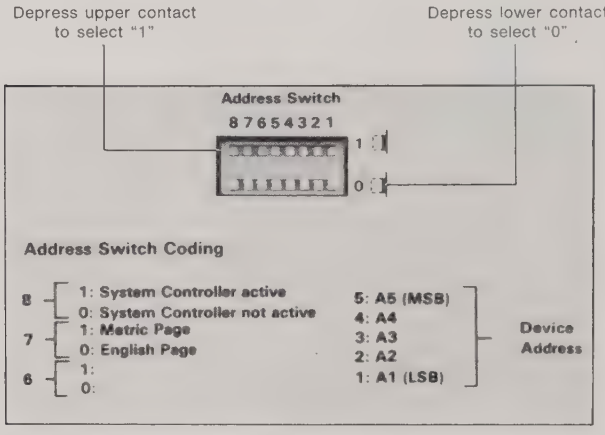


Fig. 4.2. **Address Switch** *on the rear panel of the 2313*

4.2. FUNCTIONS – GENERAL GUIDE

The basic syntax for documenting, storing and processing of measurement data with the 2313 is the same regardless of which application package is employed. First the DESTINATION must be entered and then the SOURCE, e.g.

	DESTINATION	SOURCE	
	[List]	***[2131]***	**[Exec./Ent.]**
or	**[Plot]**	***[Memory]*** **[/]** [file no.]	**[Exec./Ent.]**
or	**[7400]** [file no.]	**[/]** ***[Memory]*** **[/]** [file no.]	**[Exec./Ent.]**

Data Destination and Source:

In general, DESTINATIONS are described by the functions printed in plain text on the Control Function Overlay provided with the Application Package. Following entry of a function the **Active LED** is extinguished and the **Entering LED** is lit instead. This indicates that the 2313 is ready to receive information on the SOURCE which is described by the sub-functions printed in cursive text on the Overlay. Alternatively, numbers can be entered for specifying which memory or tape file a measurement is to be sent to, provided that this is followed by **Extension [/]** to permit entry of the SOURCE. If no SOURCE is specified then the ***2131*** is automatically chosen, while if no memory or tape file number is specified for output of a stored or recorded measurement, then memory file 0 or the currently selected tape file is selected.

Repetition of Measurement Task:

Once a specific documentation, storage or measurement task has been executed, and the **Active LED** of the 2313 is relit, the same task can be repeated simply by pressing the **Exec./Ent.** pushkey. At the same time this will automatically update the memory or tape file locations of the DESTINATION and SOURCE so that next file is chosen. Thus a whole series of separate measurements may be documented or stored in successive memory or tape files without having to re-enter the entire pushkey sequence each time.

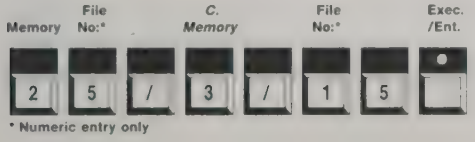
Help Information:

If a false entry is made, it may be corrected prior to execution simply by pressing the **Clear Entry** pushkey and entering the entire sequence afresh. Similarly, execution of an unwanted function or task can be terminated by activating the **Reset** key. When in doubt about the particular function, sub-function and file numbers entered, the current status of the entry can be printed by activating **Help**. e.g.

```
Selected overlay function:   2

Entered value :     5            / 3            / 15
```

corresponds to the following pushkey command:



* Numeric entry only

Stores measurement in V. Memory file 5 from C. Memory file 15

4.2.1. List [0] – Function No: 0

With the **List** function of the 2313 measurements displayed on the 2131 Frequency Analyzer can be documented as shown in Fig. 4.3. Either octave or third octave measurement data is printed, depending on the **Filter Bandwidth** setting chosen on the Analyzer. Also, details on instrument control settings, personal text, plus the date and time of each readout are included as part of the documentation heading. Any attempt to list a measurement whilst the Analyzer is overloaded by input signals of too high a peak level will result in an overload warning being printed beneath the control heading.

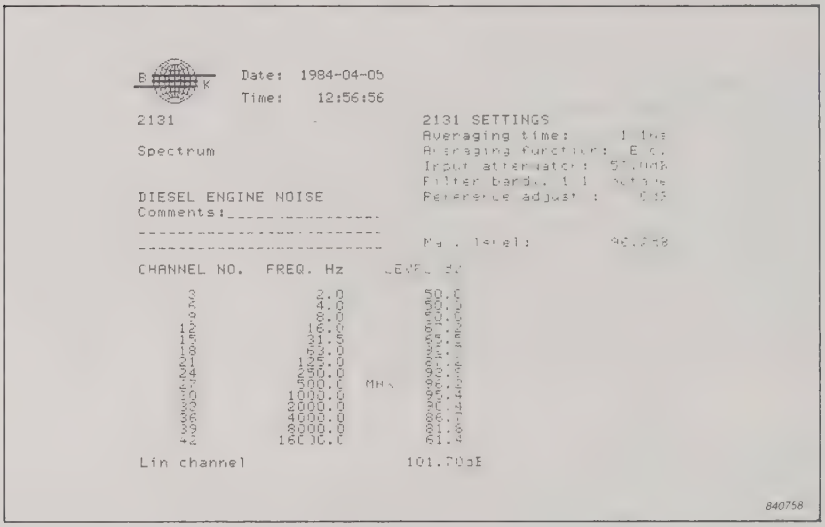


Fig. 4.3. Typical 1/1 octave listing of signal measured with the 2131 Digital Frequency Analyzer

Operating Set-Up Parameters:

The user accessible parameters controlling documentation produced by the **List** function have the parameter numbers and identities specified below. These are accessible with Operating Set-Ups No: 1, 2 and 3 of the 2313 and to suit different types of measurement may be used to alter the readout by assigning them the parameter values indicated.

```
SELECTED SETUP NO.: 0
   FUNCTION              PARAMETER                    VALUE        UNIT
 0 List                1 List from                :     0          Hz
 0 List                2 List to                  : 22000          Hz
 0 List                3 Including head           : YES
```

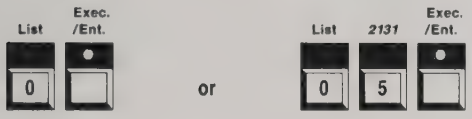
1–List from and **2–List to:** Accept any value between 0 and 22 000 Hz with default at 0 and 22 000 Hz respectively. They define filter centre frequency range over which measurements are listed. Entry of a decimal value is automatically rounded to the nearest whole number.

3–Including head: Accepts logic **Yes** or **No**, with **Yes** as default. It determines whether or not instrument control settings, comments and personal text etc., are used to head listed measurements. It has no affect on readout of date and time which are always printed to facilitate future reference.

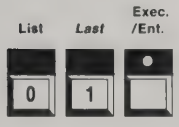
For further details on the use of Operating Set-Ups, section 3.9 should be consulted.

Basic Pushkey Commands:

For listing measurements from the 2131, either of the following pushkey sequences may be employed:



By pressing **Exec./Ent.** once again each time readout of a measurement is completed, a second or third measurement etc. may be listed without having to reactivate the **List** pushkey. Alternatively, an extra copy of the previous measurement may be obtained by entering:

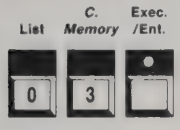


Recalls previous measurement from the 2313 Last Memory

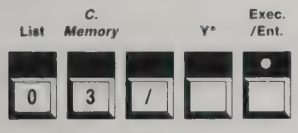
Besides documenting measurements from the Last Memory, those which have been stored using either the Volatile or Continuous Memory of the 2313 can be listed. The appropriate pushkey sequences for this purpose are illustrated below. Also given are sequences for listing measurements recorded on tape using the 2313 together with the 7400 Digital Cassette Recorder. For tape recorded measurements which have recorded directly from the 2131 without aid of the 2313, the recorded data must first be converted using the ***7400 File to BZ 7001 File*** sub-function of the 2313 (see section 4.3.10).

Lists measurement stored in 2313 V. Memory file 0

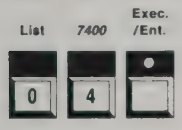
Lists measurement stored in 2313 V. Memory file Y



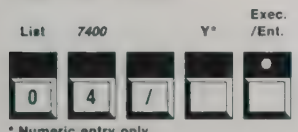
Lists measurement stored in 2313 C. Memory file 0



Lists measurement stored in 2313 C. Memory file Y



Lists measurement stored in currently selected 7400 file



Lists measurement stored in 7400 file Y

* Numeric entry only

where Y can be assigned any memory file number between 0 and 31999 or tape file number between 1 and the highest file number allocated by the 7400.

Following each readout **List** can be reactivated simply by pressing the **Exec./Ent** pushkey. This will list the measurement stored in the next file, thus making it possible to document a second or third stored measurement etc. without having to enter the entire pushkey sequence each time. Any attempt to access a non existent file will result in an appropriate error message being printed, plus return the 2313 to normal standby status. For listing subsequent files a new pushkey sequence must be entered afresh.

Use With Other Functions:

As indicated in Fig. 4.4 the 2313 may also be used to list measurements processed using the ***1/12 Octave, Average, Deviation, Decay, Reverberation***, ***Sub. Spectra*** and ***Add Spectra*** sub-functions, plus the ***Add Lin and "A"-weight*** common function. These are discussed in later sections of this chapter which also include examples of the types of readout generated.

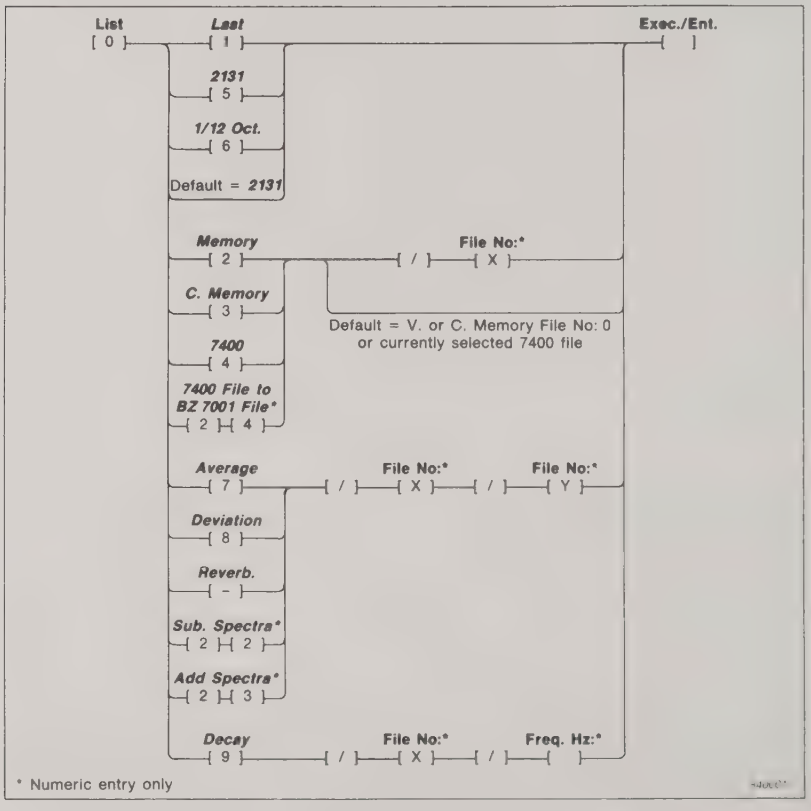


Fig. 4.4. Pushkey Sequence Chart – **List**

4.2.2. Plot [1] – Function No: 1

The **Plot** function generates fully annotated graphic plots of measurements displayed on 2131. These are similar to that shown in Fig. 4.5 and by choosing the appropriate **Filter Bandwidth** setting on the Analyzer, either octave or third octave measurements can be documented. As with the **List** function, a date and time plus instrument control setting heading are printed and there is space for entry of personal text and comments.

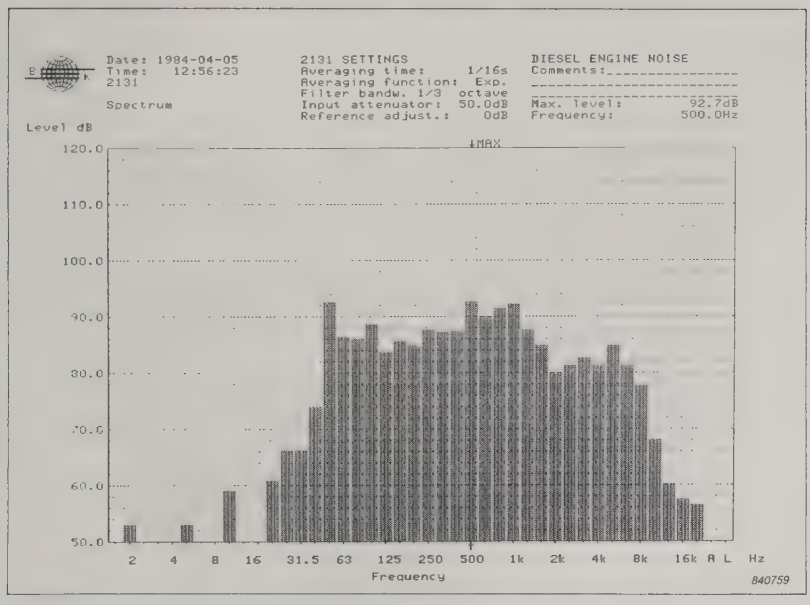


Fig. 4.5. Typical third octave plot of signal measured with the 2131 Digital Frequency Analyzer

The measured level and filter centre frequency axes of each plot are graduated in terms of dB re. 1 μV and Hz respectively and the maximum level indicated by an arrow both at the top and bottom of the corresponding frequency band on the chart. Any attempt to plot a measurement whilst the Analyzer is overloaded by input signals of too high a peak level will result in an overload warning being printed beneath the control setting heading. Also the measurement will be plotted using a paler raster.

Operating Set-Up Parameters:

The user accessible parameters controlling documentation produced by the **Plot** function have the parameter numbers and identities specified below. These are accessible with Operating Set-Ups No: 1, 2 and 3 of the 2313 and to suit different types of measurement may be used to alter the readout by assigning them the parameter values indicated.

SELECTED SETUP NO.: 0

FUNCTION	PARAMETER		VALUE	UNIT
1 Plot	1 Graphic offset	:	0	dB
1 Plot	2 Scale proportion, 25dB/	:	5	cm
1 Plot	3 Plot from	:	0	Hz
1 Plot	4 Plot to	:	22000	Hz
1 Plot	5 Graphic offset	:	0	s
1 Plot	6 Scale proportion, 2.5s/	:	5	cm

1-Graphic offset: Accepts values between 0 and 50 dB in 5 dB increments, and on default is set to 0 dB. Is used to lift the vertical axes so that measurements plotted with scale proportion of 25 dB/10 cm and 25 dB/20 cm can be properly documented without being clipped. For measurements plotted with a scale proportion of 25 dB/5 cm, use of the default value 0 dB is recommended.

2–Scale proportion, 25 dB/: Accepts values of 5, 10 and 25 cm, with 5 cm as default. It sets the scale proportion of the vertical axes giving corresponding amplitude ranges of 70, 35 and 17,5 dB respectively.

3–Plot from and **4–Plot to:** Accept any value between 0 and 22000 Hz, with default at 0 and 22000 Hz respectively. They define filter centre frequency range over which measurements are plotted. Entry of a decimal value is automatically rounded to the nearest whole number by the 2313.

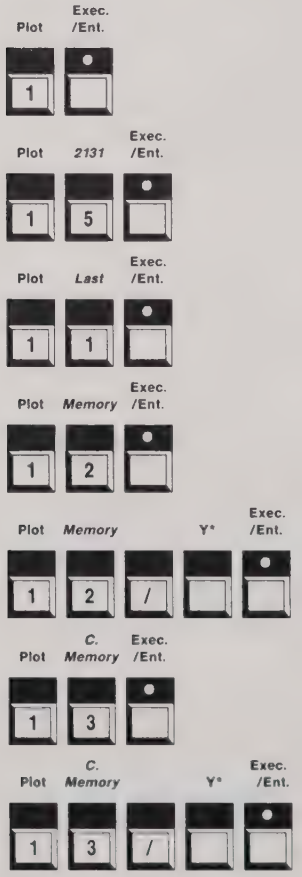
5–Graphic offset: Accepts values between 0 and 5 s in 1 s increments, and on default is set to 0 s. Is used to lift the vertical time axes of reverberation plots so that reverberation times up to 12 s can be documented without being clipped. See section 4.3.7.

6–Scale proportion, 2,5 s/: Accepts values of 5, 10 and 25 cm, with 5 cm as default. It sets the scale proportion of the vertical axes enabling 7, 3,5 and 1,75 s time ranges to be selected for reverberation plots. See section 4.3.7.

For further details on the use of Operating Set-Ups, refer to section 3.9.

Basic Pushkey Commands:

The basic pushkey commands for documenting measurements with the **Plot** function are given below. These are very similar to those used for listing measurements and therefore section 4.2.1 should be consulted where a more detailed explanation is required.



Plots measurement displayed on the 2131 Frequency Analyzer

Plots measurement displayed on the 2131 Frequency Analyzer

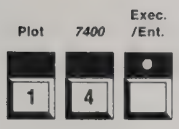
Plots previous measurement recalled from 2313 Last Memory

Plots measurement stored in 2313 V. Memory file 0

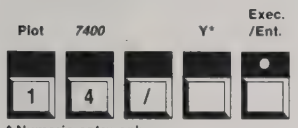
Plots measurement stored in 2313 V. Memory file Y

Plots measurement stored in 2313 C. Memory file 0

Plots measurement stored in 2313 C. Memory file Y



Plots measurement stored in currently selected 7400 file



Plots measurement stored in 7400 file Y

where Y can be assigned any memory file number between 0 and 31999 or tape file number between 1 and the highest file number allocated by the 7400.

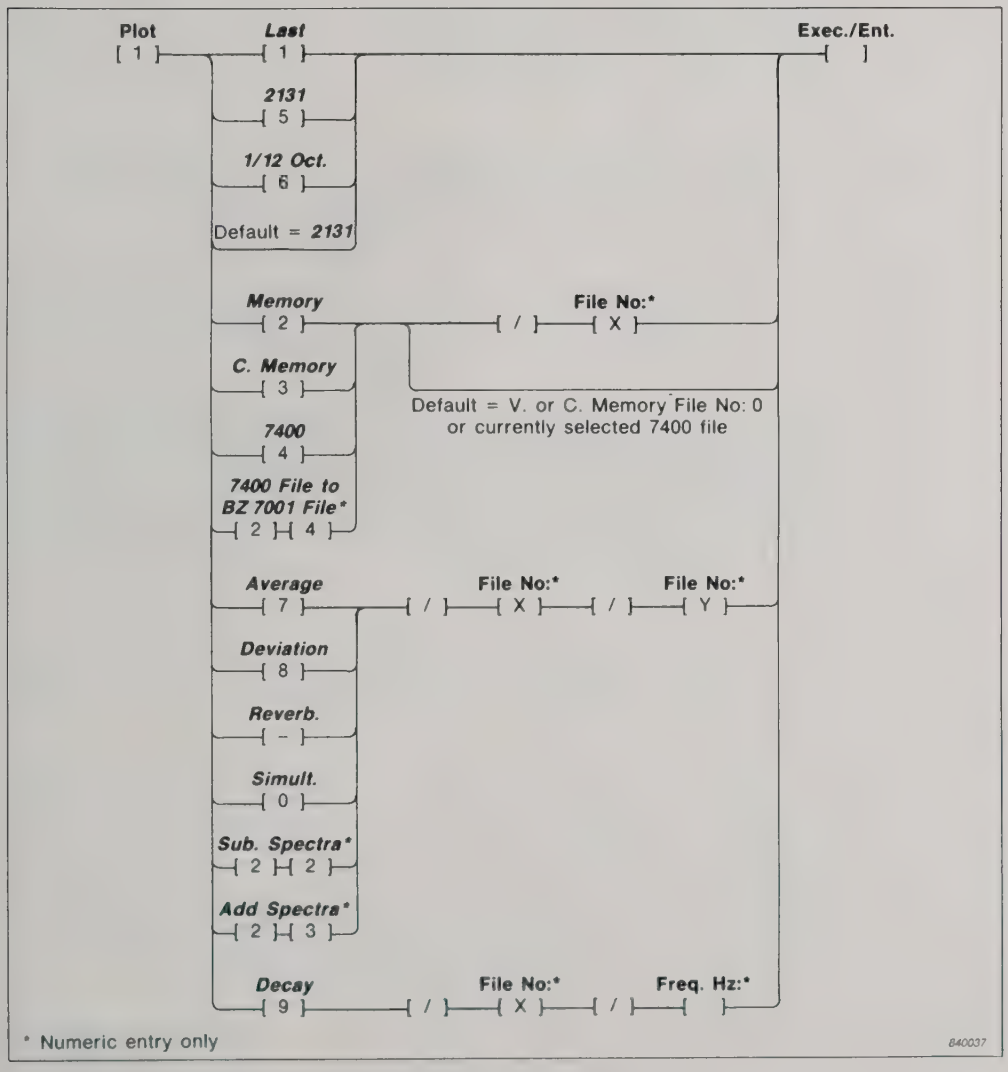


Fig. 4.6. Pushkey Sequence Chart – **Plot**

Use With Other Functions:

In addition to the above, the **Plot** may be used with the ***1/12 Octave, Average, Deviation, Decay, Reverberation***, ***Sub Spectra*** and ***Add Spectra*** sub-functions, plus ***Add Lin and "A"-weight*** common function. The relevant pushkey sequences for this purpose are illustrated in Fig. 4.6 and are discussed in later sections of this chapter which also include examples of the types of readout obtained.

4.2.3. Move to Volatile Memory [2] – Function No: 2

Using the **Memory** function of the 2313, individual measurements comprising of measurement spectra and control setting information etc., can be stored for future use. These are filed in the volatile memory and therefore may be retained as long as the Recorder is powered from the mains supply. Not only can measurements be retained for comparision and additional processing with other measurements made during the course daily use, but they can also be outputted to other digital equipment. The maximum number measurements which may be filed depends on the type of measurement and is as follows:

250 × 1/1 octave measurements
or 229 × 1/3 octave measurements
or 123 × 1/12 octave or other measurements

Operating Set-Up Parameters:

To help safeguard stored measurements, Operating Set-Ups No: 1, 2 and 3 are equipped with the following control parameters:

```
SELECTED SETUP NO.: 0
   FUNCTION            PARAMETER                    VALUE        UNIT
 2 Memory              1 Store secured        :     -1    -1
 6 Delete              1 Memory secured       :     -1    -1
```

These accept values between 0 and 31999 and permit any group of consecutive volatile memory files to be store- or delete-secured simply by entering the numbers of the first and last files of the group to be protected. Also vacant files can be secured so that once a measurement has been stored in a vacant file, subsequent attempts to delete or store new data in the same file will be blocked by the Recorder.

A particularly important point to note, is that files only remain secured whilst operating with the particular Operating Set-Up in which they are store- and delete- secured. Consequently, for reliable protection of data, it is important that the same files secured with Set-Up No: 1, for example, are also secured with Set-Ups No: 2 and 3. Also care must be exercised if the Default Set-Up No: 0 is chosen, as it is not possible to secure stored data with this Set-Up. In this case it is recommended that the **Memory Menu** function of the Recorder be activated (see section 4.2.8). This will provide a short-form listing of which files are already occuppied by the four Operating Set-Ups as well as indicate whether they are store- or delete secured.

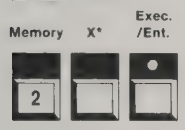
If desired store- and delete-secured protection may be disabled, to permit new measurements to be stored in place of those nolonger of interest. For this purpose a new set of parameter values may be keyed in at any time during operation, which leaves only those files containing important data secured. Where it is required to disable store- and delete-secured protection with all files, the default values of –1 to –1 should be entered.

For further details on the use of Operating Set-Ups, section 3.9 should be consulted.

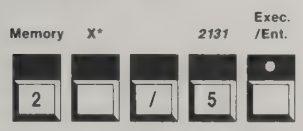
Basic Pushkey Commands:

For storing measurements in the volatile memory, the following pushkey sequences plus those shown in Fig. 4.7 apply:

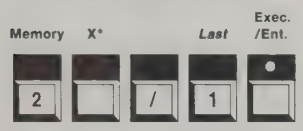
Stores measurement in V. Memory file 0 from the 2131



Stores measurement in V. Memory file X from the 2131



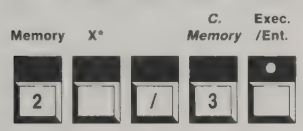
Stores measurement in V. Memory file X from the 2131



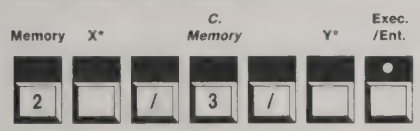
Stores measurement in V. Memory file X from the 2313 Last Memory

Stores measurement in V. Memory file X from V. Memory file 0

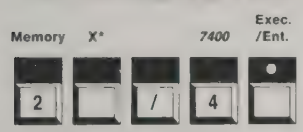
Stores measurement in V. Memory file X from V. Memory file Y



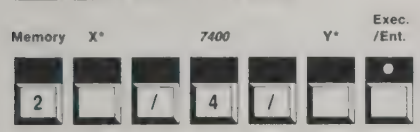
Stores measurement in V. Memory file X from C. Memory file 0



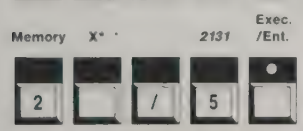
Stores measurement in V. Memory file X from C. Memory file Y



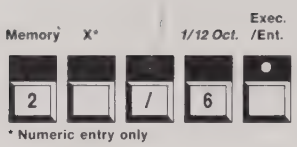
Stores measurement in V. Memory file X from currently selected 7400 file



Stores measurement in V. Memory file X from 7400 file Y



Stores measurement in V. Memory file X from the 2131



Actuates 4-pass 1/12 octave analysis storing results in V. Memory file X

where X and Y can be assigned any memory file number between 0 and 31999 or tape file number between 1 and the highest file number allocated by the 7400.

Pressing **Exec./Ent.** a second or third time after entry of any of the above sequences automatically updates the file numbers storing data in the next adjacent file. e.g.

Stores measurement in V. Memory file X from C. Memory file Y

etc.

Stores measurement in V. Memory file X+n from C. Memory file Y+n, where "n" is the number of times **Exec./Ent.** is pressed

Any attempt to store data in a store-secured file already containing data or transfering data from an empty file will permanently interrupt the above sequence plus print an error message, e.g. `File store-secured` or `File not found` .

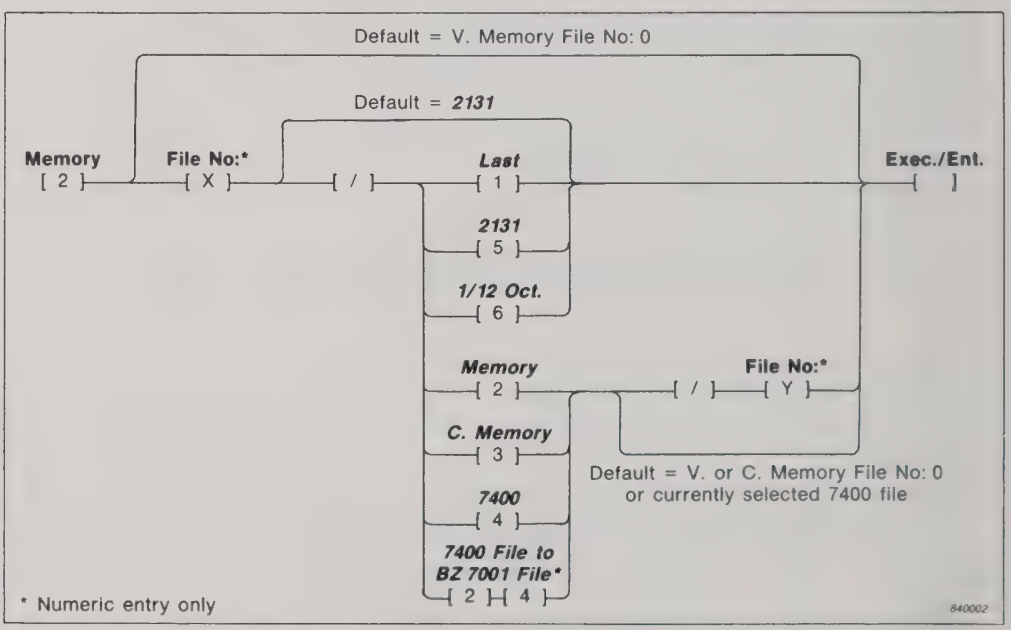


Fig. 4.7. Pushkey Sequence Chart – **Move to V. Memory**

4.2.4. Move to Continuous Memory [3] – Function No: 3

This is similar to the **Memory** function. An important difference is that measurements can be stored indefinitely, provided that the continuous memory is kept powered by the built-in Ni-Cd battery of the 2313 (see section 3.4). The maximum number of measurements which may be stored is as follows:

15 × 1/1 octave measurements
or 11 × 1/3 octave measurements
or 6 × 1/12 octave or other measurements

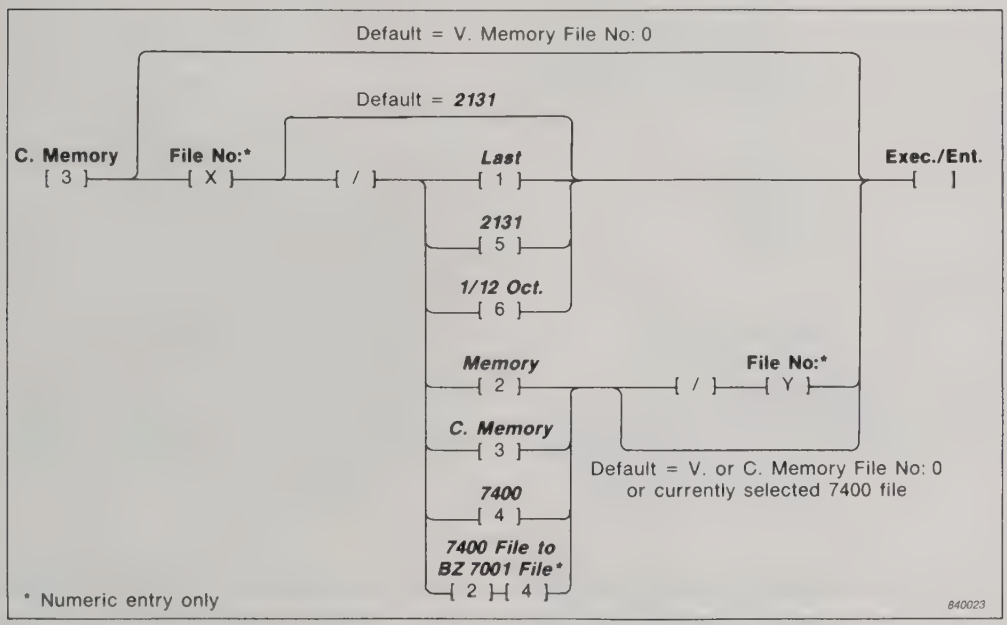


Fig. 4.8. Pushkey Sequence Chart – **Move to C. Memory**

The pushkey commands used for storing measurements are illustrated in Fig. 4.8 and are the same as those indicated in section 4.2.3, except that the **C. Memory** pushkey is used to initiate each sequence instead of the **Memory** key. Likewise any group of successive memory files may be secured using the following control parameters which except for function and parameter numbers indicated are the same those covered in section 4.2.3.

```
SELECTED SETUP NO.: 0
   FUNCTION              PARAMETER                          VALUE        UNIT
 3 Contin. Memory        1 Store secured              :     —1    —1
 6 Delete                2 Contin. memory secured     :     —1    —1
```

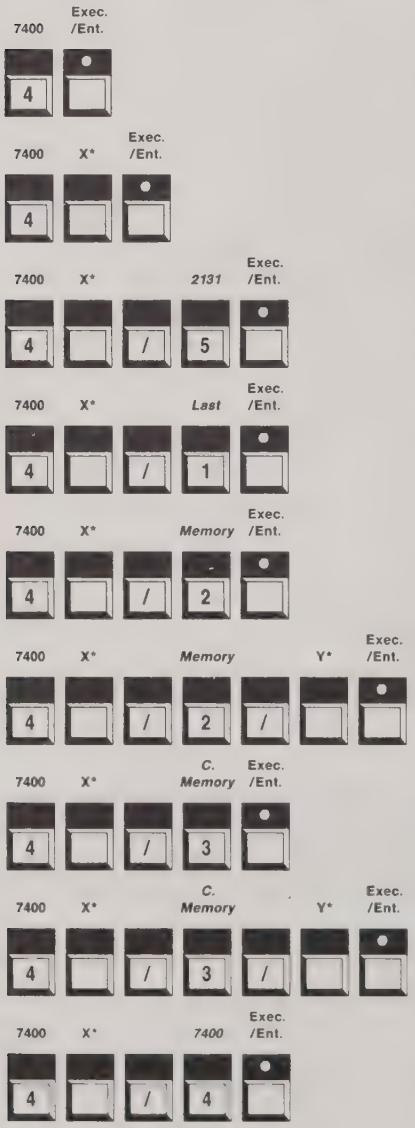
4.2.5. Move to 7400 [4] – Function No: 4

This function is useful for recording with the Digital Cassette Recorder Type 7400. Measurements presented on the display screen of the Analyzer can be recorded on tape, as well as those stored or processed using the 2313. The approximate number of measurements which can stored per side of a Digital Tape Cassette containing 300 m of tape is as follows:

1 200 × 1/1 octave measurements
or 900 × 1/3 octave measurements
or 500 × 1/12 octave or other measurements

Basic Pushkey Commands:

For recording measurements in a 7400 file, the following pushkey sequences apply:



Records measurement in 7400 file X from 7400 file Y

* Numeric entry only

Converts and stores 2131 measurement in 7400 file X from 7400 file Y – see section 4.3.10.

With the 7400, measurements are recorded sequentially with File No: allocated by the Recorder. This means that when a blank Tape Cassette is fitted, no tape file number should be entered as the destination (i.e. File No: X) as the 7400 automatically selects file no: 1 for recording the first measurement, file no: 2 for the second, and so on. If, however, a tape already containing recorded measurements is used then tape File No: –1 (i.e. **[–][1]**) should be entered as the destination. This will spool the tape to the end of the last previously recorded tape file before continuing to record a new measurement.

Following execution of any one of the above pushkey commands, the command can be reactivated simply by pressing the **Exec./Ent.** key. At the same time this will automatically update the file numbers specified, recording the measurement in the next adjacent file, thus making it possible to record a second or third measurement etc., without having to enter the entire pushkey command each time. Any attempt to record data in a write-protected file, or one which is not write-protected but is too small, will permanently interrupt the above sequence plus print an error message, e.g. `File not found`, `End of data` or `File substitution impossible due to file size`.

Tape File Substitution:

Where it is required to delete a recorded measurement and substitute one from another tape or memory file, the file numbers of both the destination and source should be specified. With new 7400 Digital Cassette Recorders (from serial number 109185) files containing measurements within all three of the following groups may be freely substituted:

Group 1: 1/1 octave spectra

Group 2: 1/3 octave spectra

Group 3: 1/12 octave spectra
Simultaneous
Reverberation
Decay
Average
Deviation

Measurement files may also be freely substituted with earlier 7400 Recorders (up to and including serial number 109185). For this purpose the Recorders must be fitted with the Tape Substitution option WH 1561 or WH 1559. If not, only files of the same length (i.e. contain measurements belonging to the same group) may be handled. Similarly, regarding substitution of B&K Soft-Function programs (see section 4.4.5) only those of identical file heading may be handled, irrespective of which Recorder is used.

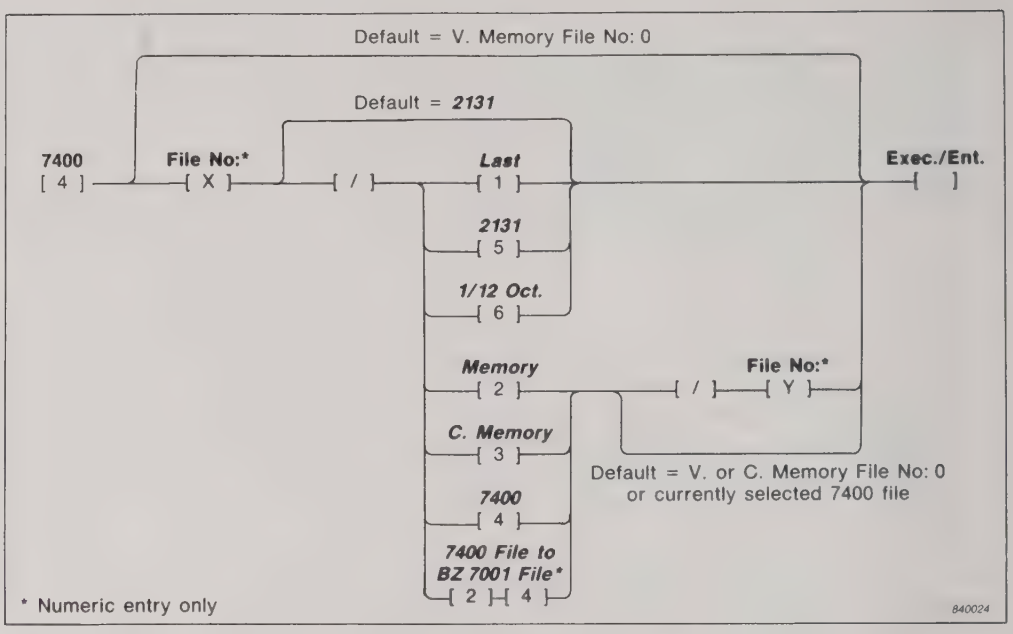


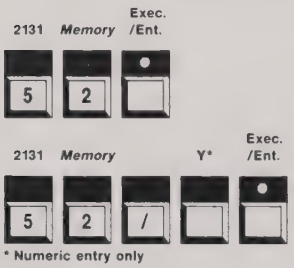
Fig. 4.9. Pushkey Sequence Chart – **Move to 7400**

4.2.6. Move to 2131 [5] – Function No: 5

The **Move to 2131** function permits stored measurements to be presented on the display screen of the 2131 Frequency Analyzer. Following display of a measurement, the 2131 can be returned to normal operating status by activating its **Input Spectrum Function "Cont."** key.

Basic Pushkey Commands:

For a displaying stored measurements on the 2131, enter one of the following:



Displays stored measurement from V. Memory file 0

Displays stored measurement from V. Memory file Y

If desired the above commands may be altered slightly for displaying measurements stored in either the Last or C. Memory of the 2313. Alternatively, measurements stored on tape with the 7400 may be displayed. For this purpose the ***Last***, ***C. Memory*** or ***7400*** pushkey should be activated instead of the ***Memory*** key (see Fig. 4.10). Where measurements stored in the Last Memory are concerned, entry of a file number is not applicable and should therefore be ignored.

Once an appropriate display command has been entered, either the 1,60 Hz to 1,25 kHz or 25,0 Hz to 20,0 kHz – 1/3 octave (or 2,00 Hz to 1,00 kHz or 31,5 Hz to 16,0 kHz – 1/1

octave) display range of the 2131 will be selected. To alternate between these ranges, the appropriate **Frequency Range** keys on the Analyzer should be pressed.

Following display of a measurement, **2131** can be reactivated simply by pressing the **Exec./Ent** pushkey. This will automatically update the file number, permitting display of a measurement stored in the next adjacent file. Any attempt to access a non existent file will result in an appropriate error message being printed, plus return the 2313 to normal standby status. For displaying subsequent files a new pushkey sequence must be entered afresh.

Note: For display of stored 1/12 octave and decay measurements using the **2131** function, sections 4.3.2 and 4.3.5 should be consulted.

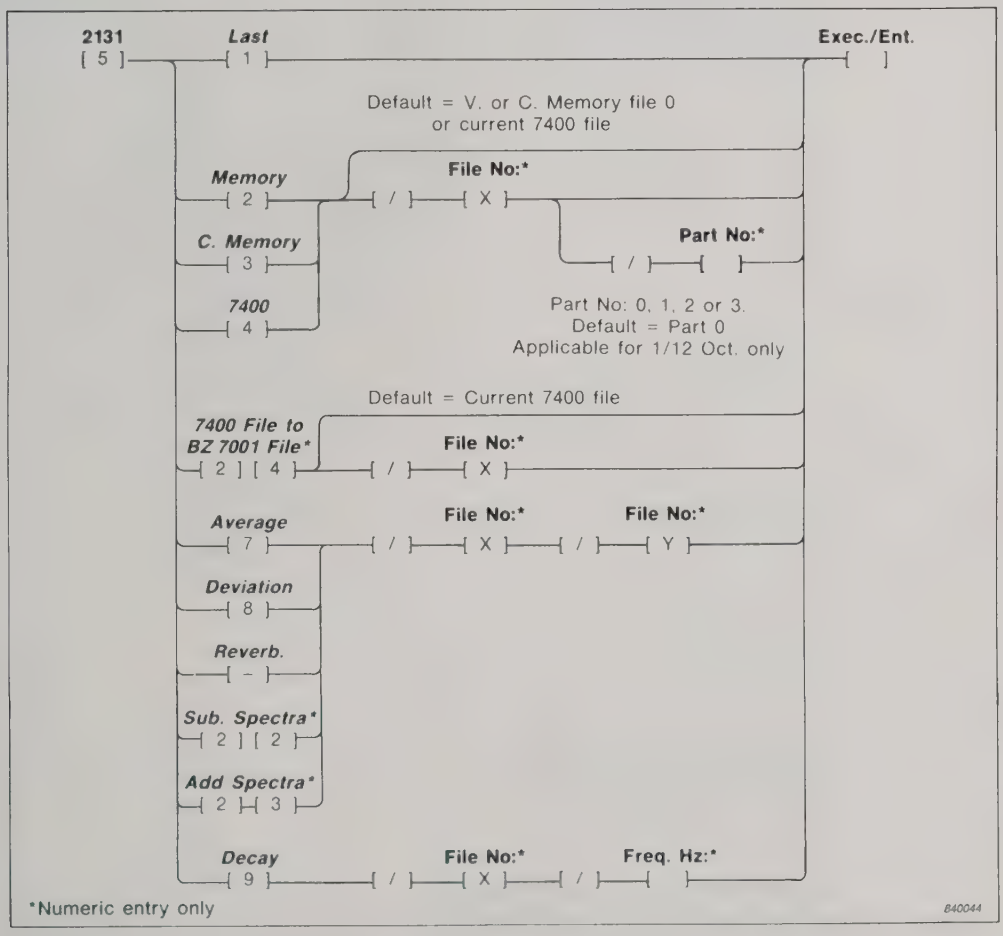


Fig. 4.10. Pushkey Sequence Chart – **Move to 2131**

4.2.7. Delete [6] – Function No: 6

The **Delete** function erases measurement data in any one or group of non delete-secured memory files of the 2313. In addition, it may be used to activate the 7400 Digital Cassette Recorder for erasing a complete side of a non-write protected Digital Tape Cassette.

Operating Set-Up Parameters:

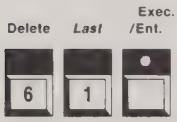
For securing consecutive V. and C. Memory files of the 2313 against delete, Operating Set-Ups No: 1, 2 and 3 are equipped with the following control parameters, the use of which are discussed in section 4.2.3.

```
SELECTED SETUP NO.: 0
   FUNCTION              PARAMETER                      VALUE        UNIT
 6 Delete                1 Memory secured          :   -1   -1
 6 Delete                2 Contin. memory secured  :   -1   -1
```

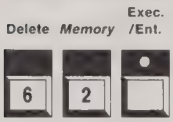
With regard to measurements stored in the Last Memory of the 2313 and on tape with the 7400, accidental deletion of data using the **Delete** function is not normally possible. This is on account that the data source has to be specified in order to execute delete. Also tape recorded data can be write-protected against delete or over recording by folding back or removing the safety tabs on the rear of the tape cassette. See section 4.2.5.

Basic Pushkey Commands:

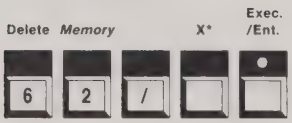
The pushkey commands used for deleting non delete-secured or write-protected measurement data, are as follows:



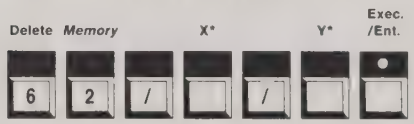
Deletes Last Memory



Deletes V. Memory file 0

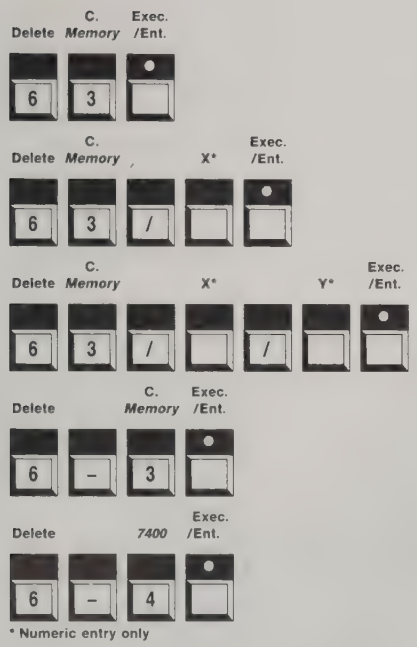


Deletes V. Memory file X



Deletes V. Memory file X to Y

Deletes all V. Memory files



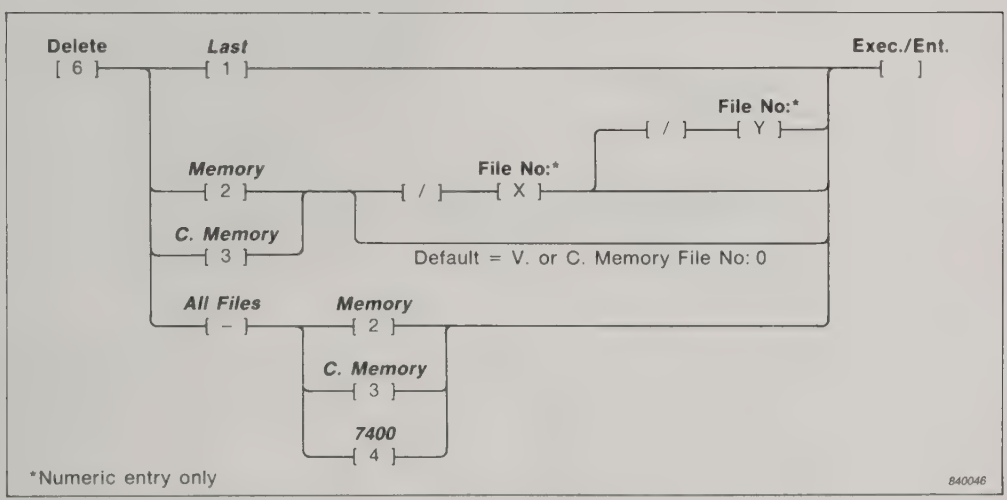


Fig. 4.11. Pushkey Sequence Chart – **Delete**

4.2.8. Memory Menu [7] – Function No: 7

This function lists short-form data on the memory and tape files utilized for storing measurements. Besides specifying file number, date and time of storage, plus type of measurement stored, it prints `DS` or `SS` alongside those memory files which are delete- or store-secured (see Fig. 4.12., plus sections 4.2.3 and 4.2.7). Where tape files not recorded with aid of the 2313 are encountered with the 7400, `Not a 2313 file` will be printed by the 2313.

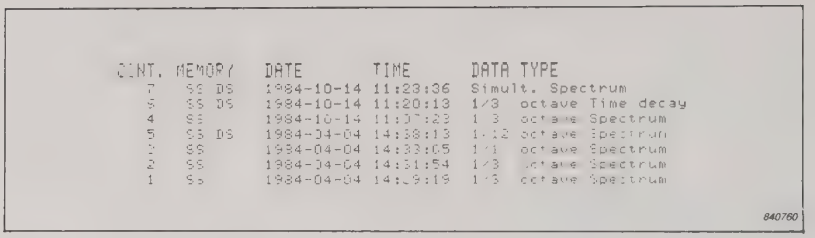
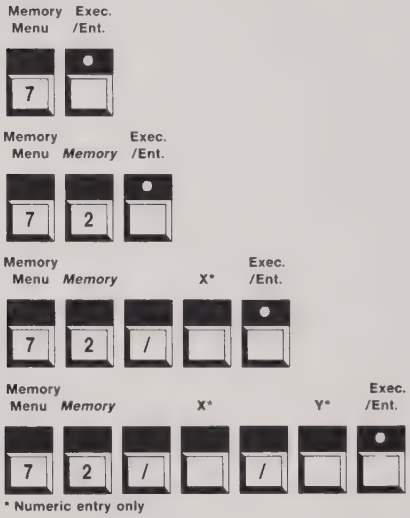

CONT. MEMORY DATE TIME DATA TYPE
7 SS DS 1984-10-14 11:23:36 Simult. Spectrum
6 SS DS 1984-10-14 11:20:13 1/3 octave Time decay
4 SS 1984-10-14 11:07:29 1/3 octave Spectrum
3 SS DS 1984-04-04 14:38:13 1/12 octave Spectrum
2 SS 1984-04-04 14:33:05 1/1 octave Spectrum
1 SS 1984-04-04 14:31:54 1/3 octave Spectrum
840760

Fig. 4.12. Typical Memory Menu of measurements stored with the C. Memory of the 2313

Basic Pushkey Commands:

The pushkey commands for listing stored data with the **Memory Menu** function are as follows:



Similarly for short-form data on C. Memory or 7400 files, press ***C. Memory*** or ***7400*** instead of the ***Memory*** pushkey (see Fig. 4.13).

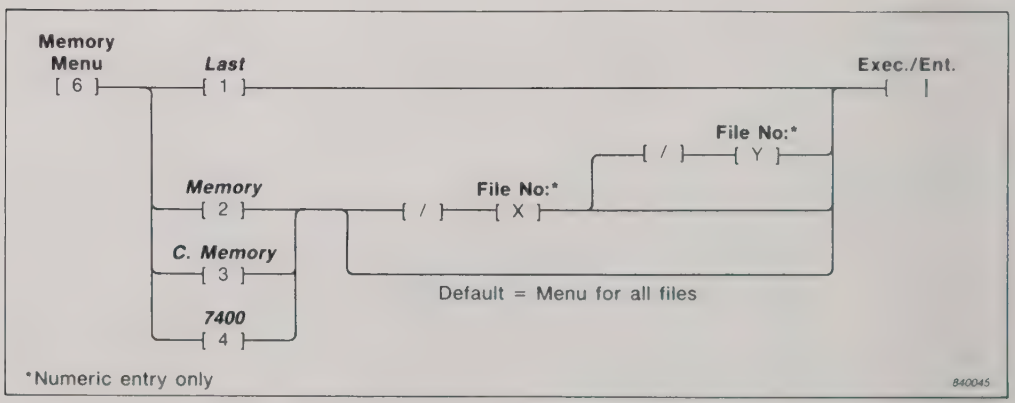


Fig. 4.13. Pushkey Sequence Chart – **Memory Menu**

4.2.9. Plot Spectra [8] – Function No: 8

The **Plot Spectra** function permits an entire series of recorded measurements to be plotted as shown in Fig. 4.14. Up to 40 1/1 or 1/3 octave measurements can documented at one time which makes it useful for three parameter amplitude–frequency–time mapping of non stationary signals recorded with the **Record Spectra** function (see section 4.2.10).

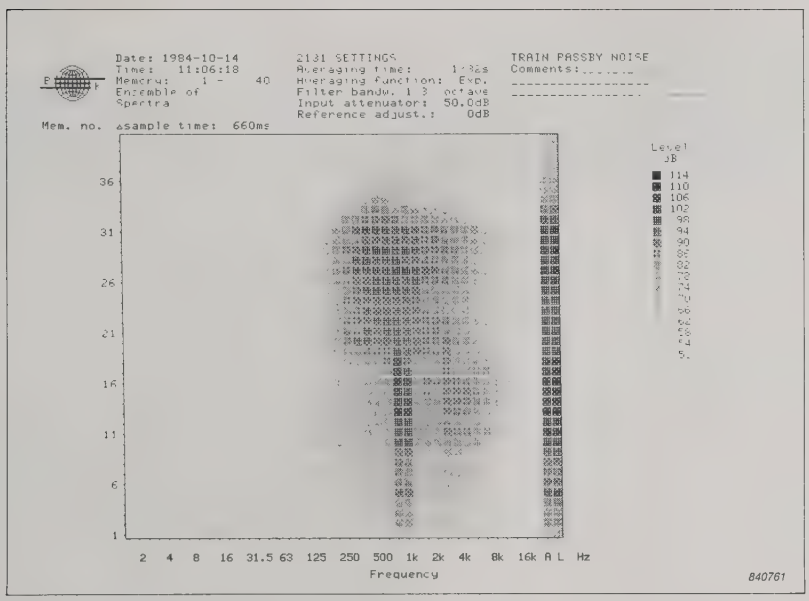
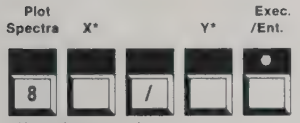


Fig. 4.14. Typical Amplitude–Frequency–Time map of train pass by noise, plotted from a series of stored measurements with aid of the **Plot Spectra** *function. Amplitude is indicated by the grey scale on the right of the plot and Time by multiplying the memory file numbers (vertical axes) by the sample time used for recording the measurements*

Basic Pushkey Command:

The pushkey command, for generating **Plot Spectra** documentation, is as follows:



Plots series of measurements from V. Memory file X to Y

Plot Spectra Readout:

As indicated in Fig. 4.14 each 1/1 or 1/3 octave filter channel of a **Plot Spectra** plot is represented by an 8 by 8 matrix block where the number of dots within each block corresponds to the measured signal level. This enables successive measurements to be stacked with the vertical axes of the plot being used to indicate the particular memory files in which measurements are recorded or stored. In addition, by multiplying the file numbers by the sample time employed for recording the measurements, the vertical axes can be used as a time scale. To obtain a sample time indication at the top of the plot, the measurements must first have been recorded as one continuous series with the **Record Spectra** function.

For plotting signal levels over a 64 dB range, a total of 64 different dot-raster blocks are employed giving a resolution of ±0,5 dB. The total number of dots making up each block corresponds to the number of dB above the base line of the plot. The actual signal level represented is indicated in 4 dB steps on the right of the plot. This takes into account the particular **Input Attenuator** setting of the Analyzer used for originally recording the measurements with the **Record Spectra** function. However, it is important that the same setting is employed throughout recording, otherwise not all measurements plotted will be correct.

Operating Set-Up Parameter:

```
SELECTED SETUP NO.: 0
   FUNCTION              PARAMETER                    VALUE       UNIT
 8 Plot spectra       1 Grid                      : No
```

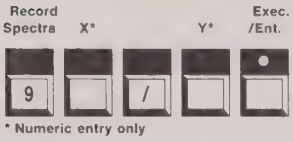
1–Grid: Accepts logic **Yes** or **No**, with **No** as default. **Yes** prints a file and frequency axes graticle to aid reading of **Plot Spectra** readouts.

4.2.10. Record Spectra [9] – Function No: 9

With **Record Spectra** one or more series of contiguous 1/1 or 1/3 octave measurements may be performed using the 2131. Results are stored in consecutive volatile memory files of the 2313 and thus can be documented individually using the **List** and **Plot** functions of the Recorder or plotted as a series of spectra using the **Plot Spectra** function. Practical applications are in recording of single events, investigation of reverberation, rise and decay times, machine monitoring etc. In addition, long term averaging of continuous signals is possible.

Basic Pushkey Commands:

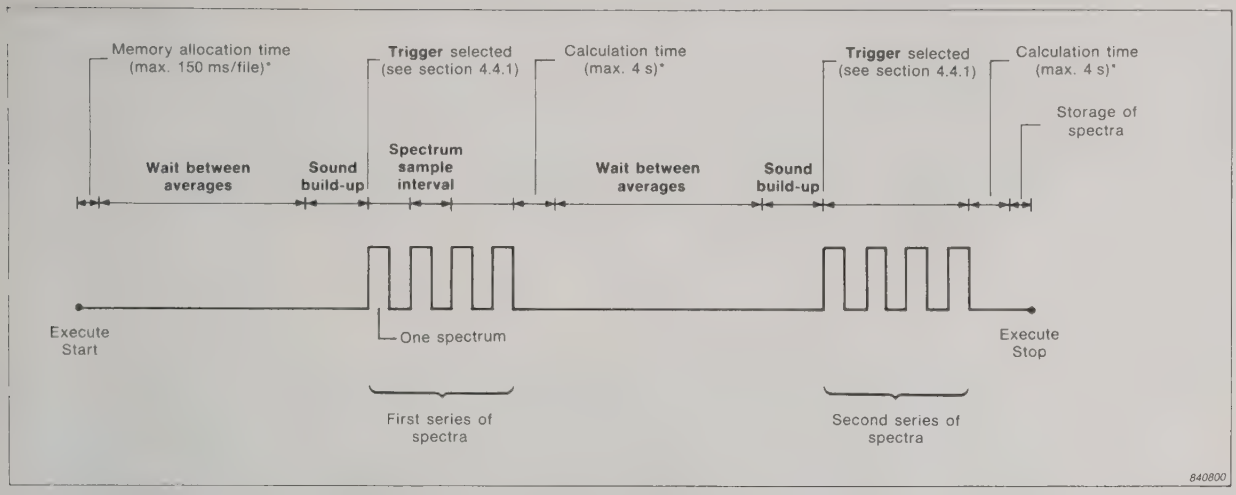
The pushkey command, for recording a series of measurements with **Record Spectra**, is as follows:



Records series of measurements from the 2131 in V. Memory files X to Y

Once **Exec./Ent.** is activated the start of the measurement sequence is delayed between 10 and 150 ms/file while the 2313 interprets the pushkey command and allocates the required number of volatile memory files. If desired a further delay may be included to make the start of record sequence coincide with the particular event of interest. For this purpose either the **Trigger** function (see section 4.4.1) or the **Record Spectra** "Sound build-up" and "Wait between averages" parameters contained in the Operating Set-Ups of the 2313 may be employed as explained overleaf.

Also included in the Operating Set-Ups is a **Record Spectra** "No. of Averages" parameter. This enables the measurement sequence to be repeated up to 1000 times and arithmetically averages the results to produce a single set of spectra. In this way a series of 219 × 1/1 octave or 87 × 1/3 octave spectra may be recorded or, if only one series of measurements is taken, a maximum of 302 × 1/1 octave or 138 × 1/3 octave spectra recorded. See Fig. 4.15.



* Depends on number of spectra and averages

Fig. 4.15. Schematic illustrating the **Record Spectra** *control sequence used for measurement, arithmetic averaging and recording of one or more series of 1/1 or 1/3 octave measurements. In the example shown two sets of measurements each comprising of four spectra are averaged*

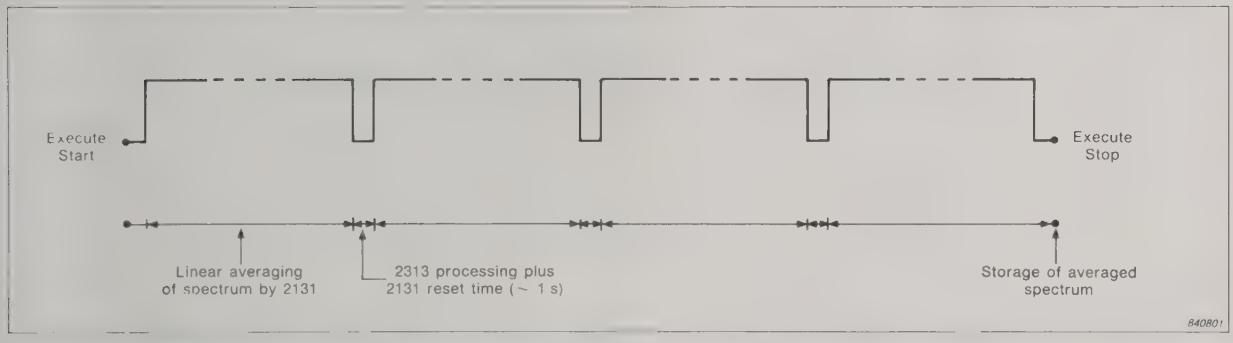


Fig. 4.16. Schematic illustrating use of **Record Spectra** *for long term linear averaging of a continuous signal. In the example shown the* **Record Spectra** *"Number of averages" parameter is set to 4 for sampling, linearally and arithmetically averaging the measured signal four times before finally recording a spectrum. The overall averaging time for the complete measurement is thus approximately four times that selected on the 2131*

In addition to the above the "Number of averages" parameter is useful for long term averaging of continuous signals. For this purpose the "Lin." averaging mode of the 2131 should be selected and a single spectrum recorded by entering the same memory file number for the X and Y parameters of the **Record Spectra** command. As indicated in Fig. 4.16, the 2131 and 2313 combination will then repeatedly sample and average the signal to record a single spectrum with effective averaging time which is almost directly equivalent to the product of the "Number of averages" and the averaging time setting of the 2131. To ensure accurate and reliable averaging, an averaging time setting which is at least a factor of 10 greater than the 1 s max. processing and reset time of the 2131 and 2313 should be chosen on the Analyzer. Also the "Wait between averages" parameter of the 2313 should be set to 0 s.

Interruption of Record Sequence and Deletion of Data:

It is important that a file series free of previously recorded measurements is specified for recording, as otherwise the measurements will be automatically deleted. Also, no stored-secured files containing stored data should be present as this will permanently interrupt the record sequence plus delete measurement data in the stored secured files. At the same time it will leave these and other files in the series with a false measurement heading despite the fact that they contain no measurement data. Similarly, a false heading will be generated if the record sequence is manually interrupted using the **Reset** key.

Operating Set-Up Parameters:

SELECTED SETUP NO.: 0

FUNCTION	PARAMETER		VALUE	UNIT
9 Record spectra	1 No. of averages	:	1	
9 Record spectra	2 Source control	:	NO	
9 Record spectra	3 Spectrum sample interval	:	2	* 22ms
9 Record spectra	4 Wait between averages	:	0	s
9 Record spectra	5 Sound build-up	:	2	s

1–No. of averages: Accepts values between 1 and 1000, with default value of 1. Determines number of times the **Record Spectra** sequence is carried out and averaged arithmetically. For example, if 4 spectra are requested with the "Number of averages" set to 2, two sets of measurements will be made. Following each set of measurements the measured amplitude in each frequency band of the individual spectra is divided by the number of averages. The results are then summed as indicated in Fig. 4.15 and recorded as one set of 4 spectra in the V. Memory of the 2313.

2–Source control: Accepts logic **Yes** or **No**, with **No** as default. **Yes** selects control of an external sound source when this is coupled to the **Remote Control** socket on the rear panel of the 2313 (see section 4.4.12). It facilitates use of the **Record Spectra** function for decay or reverberation measurements as described in sections 4.3.5 and 4.3.7 respectively.

3–Spectrum sample interval: Accepts values between 2 and 1000 × 22 ms, ×1 s or ×1 min. with default of 2 × 22 ms. Permits fixed time interval from 44 ms to 1000 minutes (i.e. 16 hours and 40 minutes) to be chosen between individual spectra.

4–Wait between averages: Accepts values between 0 and 1000 ×22 ms, ×1 s or ×1 min. with default value of 0 s. Provides fixed delay between 22 ms and 1000 minutes (i.e. 16 hours and 40 minutes) before executing each set of measurements etc., chosen with the "No. of averages" parameter of the **Record** function. See Fig. 4.15.

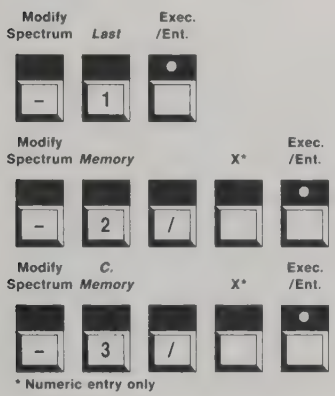
5–Sound build-up: Accepts values between 0 and 1000 ×22 ms, ×1 s or ×1 min. with default value of 2 s. Determines period an external sound source is activated, plus introduces an extra 22 ms to 1000 minute delay after each "Wait between average" delay (see Fig. 4.15). It is used to permit sound build-up in the room where the external sound source is placed for recording of reverberation and decay spectra, for example.

4.2.11. Modify Spectrum [–] – Function No: 10

With this function modification of 1/1, 1/3 or 1/12 octave spectra stored in Last, V. or C. Memories is possible. The analyzed level of contiguous frequency bands of the spectra can be individually altered either to eliminate non essential data or to generate reference spectra for subsequent comparison with other measurements. Also frequency weighting characteristics can be built up for pseudo weighting and integration of stored measurements as discussed in sections 4.3.8, 4.3.9 and 4.4.2.

Basic Pushkey Commands:

To facilitate modification using the front panel pushkeys of the 2313, stored spectra must first be presented on the display screen of the 2131. The appropriate pushkey commands for this purpose are as follows:



Displays plus permits modification of measurement from last Memory

Displays plus permits modification of measurement from V. Memory file X

Displays plus permits modification of measurement from C. Memory file X

where X can be assigned any memory file number between 0 and 249, depending on the type of measurement, storage medium etc.

Display of 1/3 and 1/1 Octave Spectra:

It is important to note that for display of 1/3 and 1/1 octave measurements, spectra are split into 2 overlapping frequency ranges (see Table 4.1).

	Range 1	Range 2
1/3 Octave	1,60 Hz to 1,25 kHz	25,0 Hz to 20,0 kHz
1/1 Octave	2,00 Hz to 1,00 kHz	31,5 Hz to 16,0 kHz

T00365GB0

Table 4.1. Centre frequency ranges for display of 1/1 and 1/3 octave spectra on the 2131 Frequency Analyzer

These may be selected using the two **Frequency Range** keys of the 2131 or the **Modify Cursor** key of the 2313. However, whereas the **Frequency Range** keys permit alternate selection of either Range 1 or 2, the **Modify Cursor** key simply steps from Range 1 to 2 when used to step pass the final centre frequency band of Range 1. In both cases the actual range selected can be seen from the built-in LEDs of the **Frequency Range** keys. Also the centre frequency and level of the individual frequency bands of the displayed spectrum can be read at the top of the display when the **Modify Cursor** key is used to

step from one band to the next. It is not recommended that the **Channel Selector** keys of the 2131 are used to step the cursor as this can interfere with modification of spectra.

Display of 1/12 Octave Spectra:

Where display of 1/12 octave analyses is concerned, spectra are divided into 4 parts, each comprising of two overlapping frequency ranges as depicted in Table 4.2.

	Range 1	Range 2
Part 0	1,41 to 7,51 Hz	2,81 to 15,02 Hz
Part 1	15,91 to 84,99 Hz	31,83 to 170,02 Hz
Part 2	180,13 to 962,23 Hz	360,33 to 1924,83 Hz
Part 3	2039,32 to 10893,83 Hz	4079,44 to 21791,93 Hz

T00366GB0

Table 4.2. Centre frequency ranges and part numbers for display of 1/12 octave spectra on the 2131 Frequency Analyzer

In this case display starts with Part 0 – Range 1 of the spectrum and is stepped to Part 0 – Range 2, Part 1 – Range 1, etc., using the **Modify Cursor** key as described above. To aid determination of the respective frequency bands it is recommended that spectra are listed before initiating display of the spectra. This is because it is not possible to obtain a 1/12 octave centre frequency indication on the 2131. However, it will give a correct level indication when stepping the display cursor from one frequency band to the next.

Modification Procedure:

Having obtained a graphic display of a stored spectrum, the **Modify Cursor** key of the 2313 may be used to select the particular frequency band to be modified. Momentarily pressing the key and releasing it again steps the display cursor one band to the right, whilst holding it pressed for a slightly longer time steps the cursor one or more bands to the left.

Following selection of a frequency band its analyzed level can be altered simply by entering the desired dB level with aid of the top two rows of pushkeys on the 2313. Activating the **Exec./Ent.** key to complete the entry, automatically updates the display in accordance with the new level, plus alters the original spectrum contained in the Last, V or C. Memory of the Recorder. At the same time it steps the display cursor one position to the right so as to permit modification of the next frequency band.

Repeated activation of the **Exec./Ent.** key after entry of a level automatically sets the adjacent frequency bands to the same level. Entry of a level below that actually shown on the 2131 or activating **Exec./Ent.** without entering a level, automatically sets the selected frequency band to the dB level corresponding to the base line of the displayed spectrum. The maximum level which may be entered is 300 dB, but normally is best kept within the display range of the Analyzer to permit subsequent documentation and comparison with other measurements.

To return to normal operation after modification is completed, press the **Reset** keys of both the 2313 and 2131.

4.3. SUB–FUNCTION GUIDE

Sub-functions are printed in cursive on the Control function Overlay and used to define the source from which measurement data is to be documented, stored or processed. As explained at the beginning of section 4.2, they may be entered after keying in a function when the **Entering LED** of the 2313 is lit.

4.3.1. *Last* [1] – Sub-function No: 1

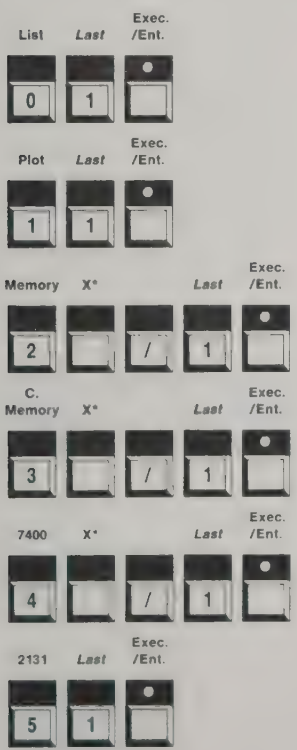
The ***Last*** sub-function implicitly stores the latest operation carried out with the 2313 so that one can always refer to it prior to proceeding with the next operation. It may be used to list a measurement which was previously plotted, for example, or to transfer results to a V. or C. Memory file etc. The types of measurement which may be stored are:

1/1, 1/3 and 1/12 octave spectra
Reverberation Measurements
Time decay curves
and Simultaneous plots

The information is placed in a special volatile memory file and therefore is retained as long as the 2313 is powered. If, however, an error arises during execution of an operation or measurement, then the information will be automatically deleted.

Basic Pushkey Commands:

The basic pushkey commands ultilizing the ***Last*** sub-function, are as follows:



Lists previous measurement retained in Last Memory

Plots previous measurement retained in Last Memory

Stores previous measurement in V. Memory file X from Last Memory

Stores previous measurement in C. Memory file X from Last Memory

Records previous measurement in 7400 file X from Last Memory

Displays previous measurement on 2131 from Last Memory

Deletes previous measurement retained in Last Memory

Prints menu of previous measurement retained in Last Memory

where X can be assigned any memory file number between 0 and 31999, or tape file number between 1 and 1200, depending on the type of measurement, storage medium etc.

4.3.2. *1/12 Octave* [6] – Sub-function No: 16

This is a sub-function of **List, Plot, Move to Memory** etc., and remotely switches the filter coefficients of the 2131 enabling it to perform a 4-pass 1/12 octave analysis. Analysis is based on a combination of four consecutive frequency scans, each utilizing a different filter coefficient (see Fig. 4.17). Intermediate results of each scan are displayed on the 2131 during the course of the analysis but have to be sorted and reassembled by the 2313 to obtain a meaningful 1/12 octave frequency spectrum (see Fig. 4.18). The overall accuracy of the analysis is the same as that for 1/1 and 1/3 octave measurements with the 2131.

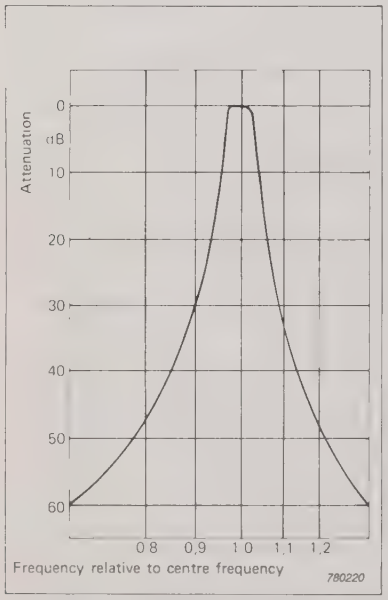


Fig. 4.17. Typical 1/12 oct. filter characteric for 4-pass 1/12 octave analysis with a 2131 and 2313

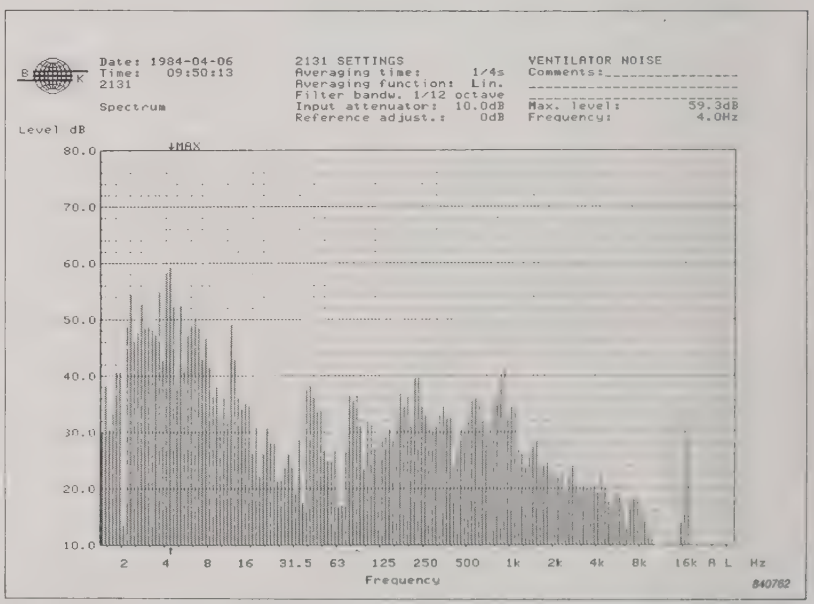
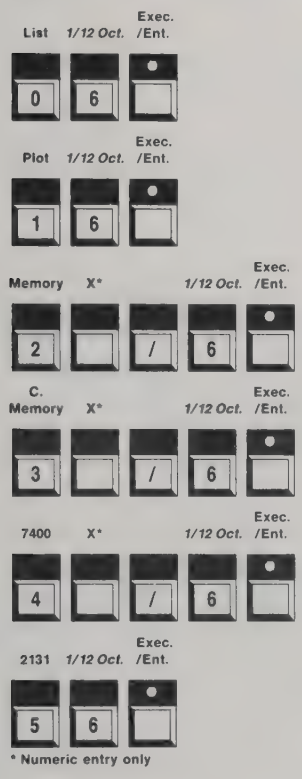


Fig. 4.18. Typical 1/12 octave plot produced by the 2313. The minimum valid frequency for the analysis is chosen using the **Set-Up** *mode and is indicated by "∧" printed just beneath the frequency scale of the plot*

Basic Pushkey Commands:

The pushkey commands for performing a 1/12 octave analysis, plus documenting and storing results, are as follows:


List 1/12 Oct. Exec. /Ent.
0 6
Plot 1/12 Oct. Exec. /Ent.
1 6
Memory X* 1/12 Oct. Exec. /Ent.
2 / 6
C. Memory X* 1/12 Oct. Exec. /Ent.
3 / 6
7400 X* 1/12 Oct. Exec. /Ent.
4 / 6
2131 1/12 Oct. Exec. /Ent.
5 6
* Numeric entry only

Actuates 4-pass 1/12 octave analysis plus lists results

Actuates 4-pass 1/12 octave analysis plus plots results

Actuates 4-pass 1/12 octave analysis storing results in V. Memory file X

Actuates 4-pass 1/12 octave analysis storing results in C. Memory file X

Actuates 4-pass 1/12 octave analysis storing results in 7400 file X

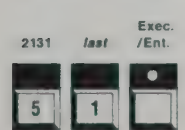
Actuates 4-pass 1/12 octave analysis plus displays first part of spectrum on the 2131

On pressing the **Exec./Ent.** key, the 2313 automatically sets the **Input Spectrum Function** of the 2131 to "Cont.". The analysis then proceeds either under automatic control of the 2313 or, if manual control has been chosen, waits until the **Averaging Start** "Lin" key on the 2131 is pressed to start each frequency scan in turn when directed by the 2313 i.e. prints `Press <Lin>` . The type of control as well as the minimum valid frequency for the analysis is chosen with aid of the Operating Set-Up parameters described at the end of this section.

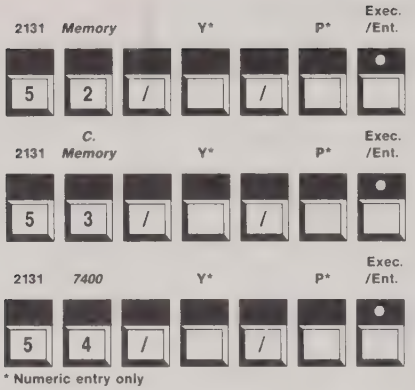
After completion of the analysis, the 2313 automatically transmits the results to the particular destination requested plus returns the 2131 to the controls settings used before analysis was initiated. At the same time it also temporarily stores results in the Last Memory, thus enabling them to be transferred to another destination other than that orginally requested. See ***Last*** sub-function – section 4.3.1.

Display of 1/12 Octave Spectra

Besides documentation and storage, 1/12 octave analyses may be presented on the display screen of the 2131. For this purpose analyses must first be stored in a memory or tape file, and then transferred to the 2131 using one of the following commands:



Displays Part 0 of stored measurement from Last Memory



As it is not possible to display all frequency bands of a 1/12 octave spectrum simultaneously, it is divided into four parts. Each part covers 42 consecutive frequency bands and is further subdivided into two overlapping ranges of 32 bands, as indicated in Table 4.3 below.

1/12 Octave Band Centre Frequencies

Part 0		Part 1		Part 2		Part 3	
Hz		Hz		Hz		Hz	
1,41	2*	15,91	2*	180,13	2*	2039,32	2*
1,49		16,86		190,84		2160,62	
1,58		17,86		202,19		2289,13	
1,67		18,92		214,22		2425,29	
1,77	Range 1	20,05	Range 1	226,96	Range 1	2569,55	Range 1
1,88		21,24		240,46		2722,39	
1,99		22,50		254,77		2884,32	
2,11		23,84		269,92		3055,88	
2,23		25,26		285,97		3237,64	
2,36		26,76		302,98		3430,22	
2,50		28,35		321,01		3634,25	
2,65		30,04		340,10		3850,42	
2,81	14*	31,83	14*	360,33	14*	4079,44	14*
2,98		33,72		381,76		4322,09	
3,16		35,73		404,47		4579,17	
3,34		37,85		428,53		4851,54	
3,54		40,10		454,01		5140,11	
3,75		42,49		481,02		5445,85	
3,98		45,01		509,63		5769,77	
4,21		47,69		539,94		6112,95	
4,46		50,53		572,06		6476,56	
4,73		53,53		606,09		6861,78	
5,01	Range 2	56,72	Range 2	642,14	Range 2	7269,93	Range 2
5,31		60,09		680,33		7702,34	
5,62		63,67		720,80		8160,48	
5,96		67,45		763,67		8645,87	
6,31		71,47		809,09		9160,13	
6,69		75,72		857,22		9704,98	
7,09		80,22		908,21		10282,24	
7,51	31*	84,99	31*	962,23	31*	10893,83	31*
7,95		90,05		1019,46		11541,80	
8,43		95,40		1080,10		12228,31	
8,93		101,08		1144,34		12955,65	
9,46		107,09		1212,41		13726,26	
10,02		113,46		1284,52		14542,70	
10,62		120,21		1360,93		15407,71	
11,25		127,36		1441,88		16324,16	
11,92		134,93		1527,64		17295,13	
12,63		142,96		1618,50		18323,85	
13,38		151,46		1714,77		19413,76	
14,17		160,47		1816,77		20568,50	
15,02	43*	170,02	43*	1924,83	43*	21791,93	43*

* Corresponding 2131 channel number

T00379GB0

Table 4.3. Part numbers, frequency ranges, filter centre frequencies and 1/3 octave channel numbers for display of 1/12 octave measurements on the 2131

Where no Part No. is entered for display of a stored spectrum, Part 0 is automatically chosen. To step between Range 1 and 2, press the appropriate **Frequency Range** key on the 2131. Similarly, to step from Part 0 to Part 1 etc., press the **Exec./Ent.** key of the 2313.

Any attempt to step beyond Part 3 of a spectrum from a V. or C. Memory file will automatically display the next V. or C. Memory file or print `File not found` and return to 2313 to standby. With a spectrum from the Last Memory or a 7400 tape file, however, the 2131 will remain with Part 3 selected until the **Reset** key of the 2313 is pressed. To return the 2131 to normal operating status, press its **Input Spectrum Function** "Cont" key.

Operating Set-Up Parameters:

```
SELECTED SETUP NO.: 0
   FUNCTION              PARAMETER                        VALUE        UNIT
16 1/12 octave        1 Man. scan                   : NO
16 1/12 octave        2 Valid low freq. in auto.    :    80           Hz
```

1–Man. scan: Accepts logic **Yes** or **No** for selection of manual or automatic scanning respectively, with **No** as default.

2–Valid low freq: Accepts values between 1 and 640 Hz, with 80 Hz as default. Is used to specify the lowest frequency of interest when automatic scanning is employed and ensures that there is sufficient time delay between passes for the filters to stabilize. The higher frequency, the shorter the measurement time (640 Hz ~ 30 s. 80 Hz ~ 35 s. 10 Hz ~ 1 min. 2 Hz ~ 3 min. 1 Hz ~ 6 min).

4.3.3. *Average* [7] – Sub-function No: 17

Average is a sub-function of **List, Plot** and **2131**. It is used to determine the average spectrum of a series of 1/1 or 1/3 spectra such as recorded with the **Record Spectra** function (see Fig. 4.19). Similarly, a series of 1/12 octave spectra, reverberation or decay measurements may be averaged, provided that these are recorded using identical controls settings on the Analyzer and are stored in consecutive volatile memory files of the 2313. Any attempt to process disimilar types of measurement, generates an appropriate error message, e.g. `Memories of different type` .

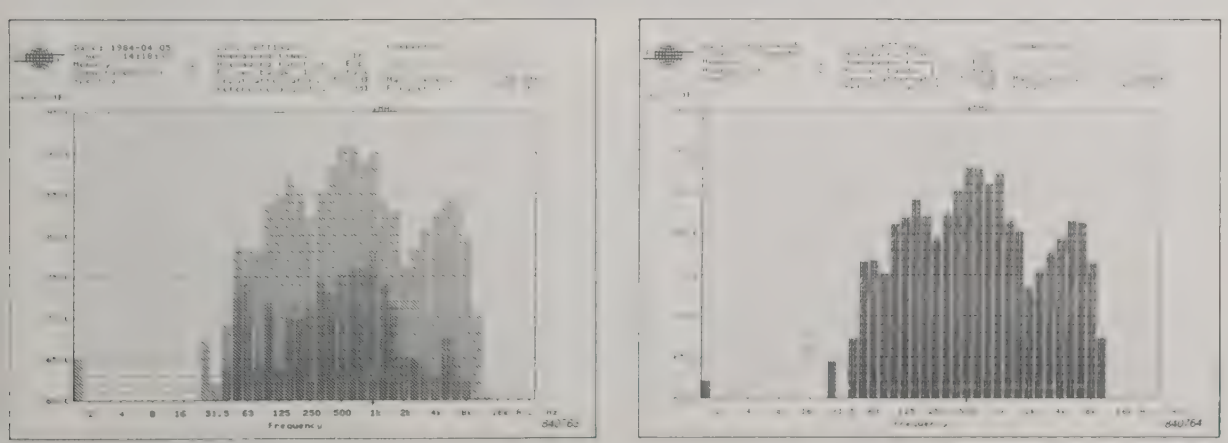
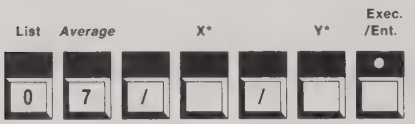


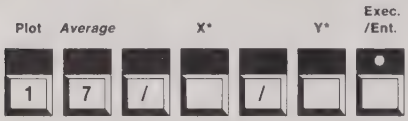
Fig. 4.19. Two 1/3 Octave Spectra plus their average spectrum (arithmetic-form) as plotted using the 2313

Basic Pushkey Commands:

The basic pushkey commands employed for averaging, plus listing, plotting or displaying results are as follows:



Lists average of measurement series from V. Memory files X to Y



Plots average of measurement series from V. Memory files X to Y

Displays average on 2131 of measurement series from V. Memory files X to Y

* Numeric entry only

Following execution, the results of averaging are automatically placed in the Last Memory and thus may be transferred to a V. or C. Memory file to facilitate further processing at a later date.

Operating Set-Up Parameters:

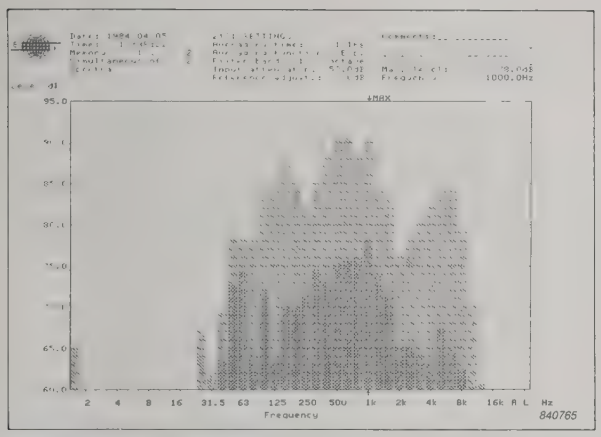
Utilizing the **Set-Up** mode of the 2313, either arithmetic averaging or averaging in dB form may be selected. Selection is made by entering **Yes** for arithmetic and **No** for averaging in dB form (see below). Arithmetic determines the equivalent RMS value (i.e. *antilog$_{10}$ dB level/10*) of the signal level within corresponding frequency bands, whilst that in dB form operates directly in dB and extracts the mean level.

```
SELECTED SETUP NO.: 0
   FUNCTION              PARAMETER                    VALUE        UNIT
17 Average           1 Arithmetical              : YES
```

1–Arithmetical: Accepts logic **Yes** for arithmetic averaging (and default), or **No** for averaging in dB form.

4.3.4. *Deviation* [8] – Sub-function No: 18

This is a sub-function of **List, Plot** and **2131**, and evaluates the standard amplitude deviation between corresponding frequency bands of a series of spectra stored in the volatile memory of the 2131. Both 1/1 and 1/3 octave spectra may be processed, as well as 1/12 octave spectra, reverberation and decay measurements. However, it is important to note that only similar types of measurement can be handled at any one time and that they must be recorded using identical controls settings on the Analyzer plus stored in consecutive volatile memory files of the 2313. Any attempt to process disimilar types of measurement, generates an appropriate error message, e.g. **Memories of different type** .



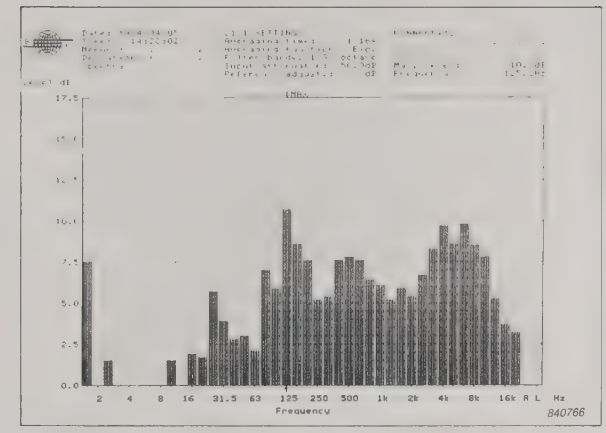


Fig. 4.20. Two 1/3 Octave Spectra plus Standard Deviation Plot (dB-form) showing the amplitude deviation between corresponding frequency bands of the two spectra

Basic Pushkey Commands:

The basic pushkey commands for obtaining a ***Deviation*** readout are as follows:

Lists deviation of measurement series from V. Memory files X to Y

Plots deviation of measurement series from V. Memory files X to Y

Displays deviation on the 2131 of measurement series from V. Memory files X to Y

* Numeric entry only

Following execution of the above commands measurement results are placed in the Last Memory. If necessary they may be transfered to the V. or C. Memory file for future reference.

Operating Set-Up Parameters:

Using the **Set-Up** mode the ***Deviation*** sub-function may be set to provide either the arithmetic deviation or the deviation in dB form as indicated below. Both give the standard deviation in dB, however, with the former amplitude samples are based on RMS values (i.e. *antilog$_{10}$ dB level/10*), whilst with the latter they are in dB.

```
SELECTED SETUP NO.: 0
   FUNCTION              PARAMETER                    VALUE        UNIT
18 Deviation          1 Arithmetical          : YES
```

1–Arithmetical: Accepts logic **Yes** for arithmetic deviation (and default), or **No** for deviation in dB form.

Note: Due to the wide difference in results obtained with the two forms of deviation measurement, it is not always possible to obtain an on scale readout. This is particularly the case when the **2131** function is employed as it always selects a fixed 0 to 60 dB display range for a deviation readout. Never-the-less, the correct deviation in each frequency band can be read from the level indication at top of the display by adjusting the display cursor of the Analyzer.

The above problem can also arise with the **Plot** function. However, in this case an on-scale readout can usually be obtained by altering the **"Graphic offset"** and **"Scale proportion"** parameters of the **Plot** function. See section 4.2.2.

4.3.5. *Decay* [9] – Sub-function No: 19

With this sub-function any individual frequency band of a series of consecutive 1/1 or 1/3 octave measurements may be documented using the **List** and **Plot** functions of the 2313. As many as 160 measurements may be sampled and documented at one time, which makes it particulary useful for investigating the rise or decay of non stationary signals recorded with the **Record Spectra** function. An example of the type of readout obtained is shown in Fig. 4.21.

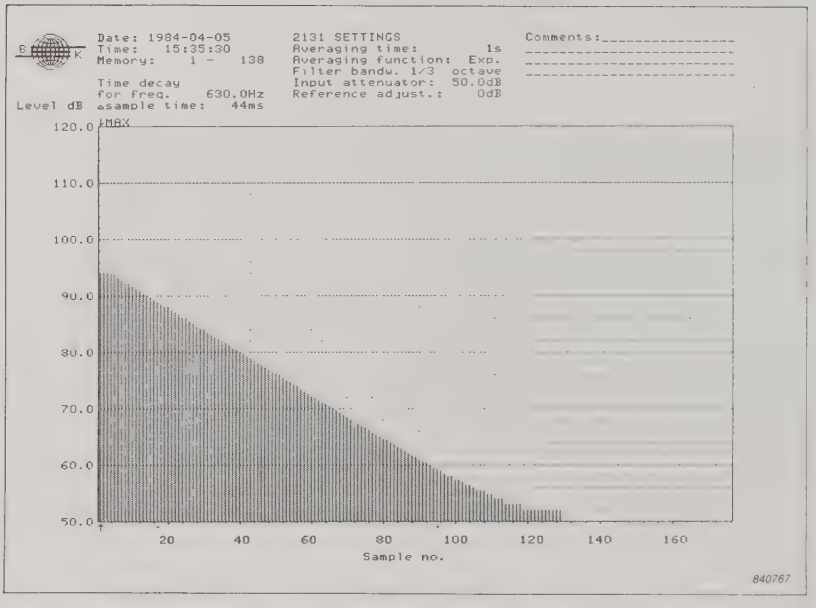
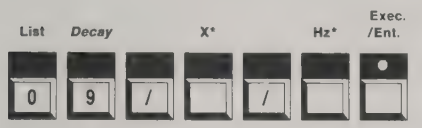


Fig. 4.21. Typical time decay plot of a single frequency band of a series of 1/3 octave spectra. For a time axis multiply the memory sample numbers by the sample time indicated at the top of the readout

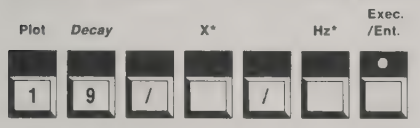
Apart from lists and plots, there is the choice of displaying decay measurements on the 2131. In this case a maximum 42 single band samples may be handled of which samples 1 to 31 and 13 to 42 are viewed by pressing the appropriate **Frequency Range** key of the 2131.

Basic Pushkey Commands:

The pushkey commands used for documenting and displaying single frequency band samples with the ***Decay*** sub-function are as follows:



Lists frequency band (Hz) of measurement series from consecutive V. Memory files ≥ X



Plots frequency band (Hz) of measurement series from consecutive V. Memory files ≥ X

Displays frequency band (Hz) of measurement series from consecutive V. Memory files ≥ X

* Numeric entry only

where the first file of the measurement series and the particular frequency band to be sampled may be entered as a one to five digit number, the latter being automatically rounded to the nearest 1/3 octave centre frequency by 2313. Before entering this data, however, the number of measurement files to be sampled should be set using the **Set-Up** mode of the Recorder (see Operating Set-Up Parameters, described below). If the number of files requested is greater than that actually used for recording the measurement series or the measurements are not recorded as an uninterrupted series, then the decay readout will be inhibited and a corresponding error message generated instead, e.g. `File not found`, `Break in memory file series` .

On completion of a decay readout, results are automatically placed in the Last Memory, thus enabling them to be transferred to a V. or C. Memory file for future reference. Alternatively, they may be stored to facilitate further processing using the ***Add***, ***Subtact***, ***Average*** and ***Deviation*** sub-functions of the 2313.

Operating Set-Up Parameters:

```
SELECTED SETUP NO.: 0
   FUNCTION              PARAMETER                    VALUE        UNIT
SUBFUNCTIONS:
 19 Time decay curve   1 Number of files          :     39
 19 Time decay curve   2 Show reverb. interval    : No
```

1–Number of files: Accepts values from 0 to 160, and has the default value of 39. It is used to specify the maximum number of consecutive memory files sampled for a decay readout. To permit readout, it is important that the number of files set with the **Decay** function does not exceed that actually used for storing the measurement series.

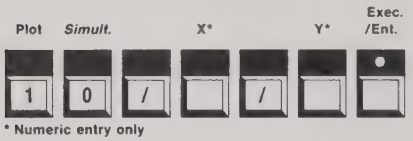
2–Show reverb. interval: Accepts logic **Yes** or **No**, with **No** as default. **Yes** marks a list or plot with a > or ∧ symbol indicating the memory sample interval used for determination of reverberation time with the ***Reverberation*** sub-function. See section 4.3.7.

4.3.6. *Simultaneous* [0] – Sub-function No: 20

This is a sub-function of **Plot** and is capable of documenting any two 1/1 or 1/3 octave, reverberation or decay measurements, simultaneously. Measurements must be of the same type and have been previously recorded in the Volatile Memory. Where measurements stored in another memory file or 7400 file are concerned, they must first be transferred to the Volatile Memory.

Basic Pushkey Command:

The pushkey command for readout of a Simultaneous Plot, is as follows:



Plots measurements from V. Memory files X and Y

An example of the type of readout produced is shown in Fig. 4.22. To help identify the separate measurements, plus show their individual levels without one hidding the other, each is plotted with a contrasting raster. Normally an accurate level indication is obtained, regardless of whether the same **Input Attenuator** settings of the Analyzer are used for originally recording the measurements or not. However, where different settings have been used, `Different settings` is printed as a warning at the top of the plot.

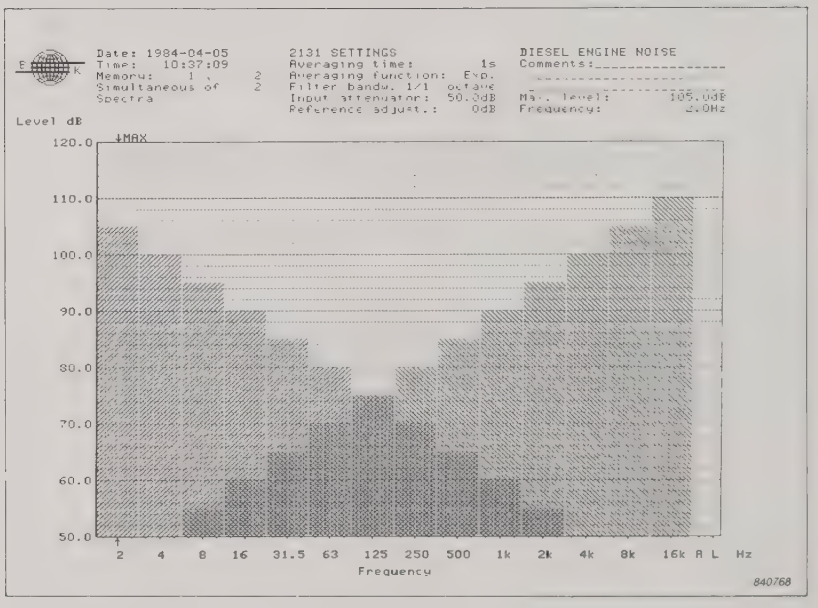


Fig. 4.22. Simultaneous plot of two modified spectra

On completion of a simultaneous plot, results are placed in the Last Memory, thus enabling them to be transferred to a V. or C. Memory file for readout at a later date. For subsequent readout of spectra already processed using **Simult.**, the **Plot** function should be used instead. Use of **Simult.** with the **List** and **Move to 2131** functions of the 2313 is not possible.

4.3.7. *Reverberation* [–] – Sub-function No: 21

Reverb. is a sub-function of **List**, **Plot** and **Move to 2131** and in many respects is similar to the ***Decay*** sub-function described in section 4.2.5. However, instead of sampling a single frequency band of a series of 1/1 or 1/3 octave spectra recorded with the **Record Spectra** function, it samples each individual band in turn to determine their equivalent reverberation time. A typical example of a reverberation plot is shown in Fig. 4.23.

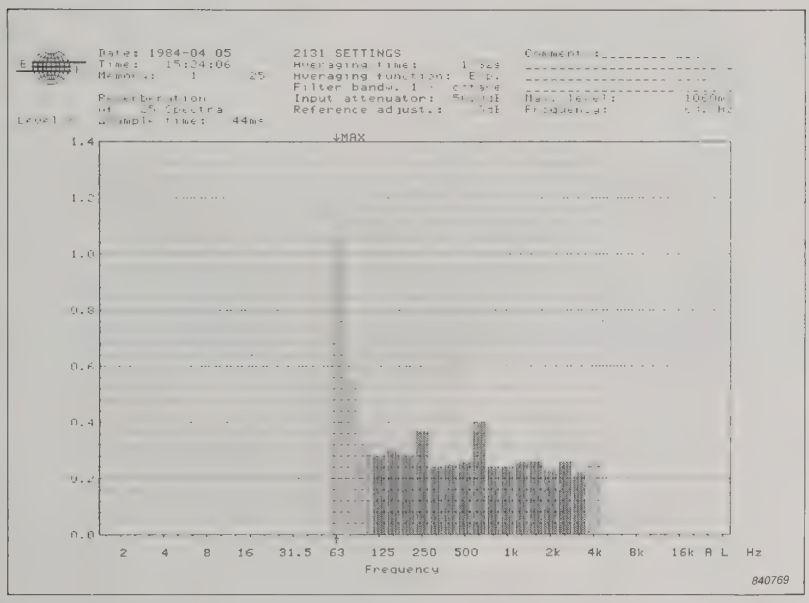
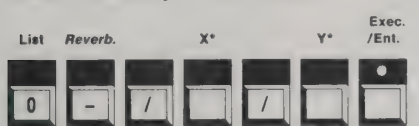


Fig. 4.23. Typical reverberation plot generated from a series of 1/3 octave measurements recorded with the **Record Spectra** *function*

Basic Pushkey Commands:



Lists reverberation spectrum of measurement series from V. Memory file X to Y

Plots reverberation spectrum of measurement series from V. Memory files X to Y

Displays reverberation spectrum of measurement series from V. Memory file X to Y

* Numeric entry only

Measurement and Readout:

Generation of a reverberation readout is based on sampling the level vs. time history of a series of recorded spectra. From this the average rate of decay for each of the individual frequency bands of the spectra is determined by linear regression and as per

definition is then divided into 60 dB so as to yield the effective reverberation time of each band.

Measurement is initiated immediately the sampled level in each frequency band falls below a preset upper limit specified with the Operating Set-Ups of the 2313. Likewise it is terminated immediately the level falls below a preset lower limit or at some point above this if the level nolonger continues to decay. This enables a readout to be obtained for most frequency bands, regardless of whether their level decays over the complete range set by the upper and lower limits or not. Also the decay need not be linear as the average rate of decay is measured. For a readout of the determination interval limits as well as the decay in each frequency band, the ***Decay*** sub-function may be employed (see section 4.3.5)..

The time taken to generate a reverberation readout depends on the number of memory files sampled and is approximately 400 ms/file. The maximum reverberation time listed, plotted or displayed is 327, 12 and 6 s respectively. For plotting times greater than 7 s, however, a graphic offset has to be added to the readout (see section 4.2.2). Where the reverberation time is determined over only part of the decay range specified with the Operating Set-Ups, it is plotted with a paler raster or listed with an asterisk, indicating that it is an approximation. Furthermore, where it is likely that it is influenced by the particular averaging time selected for recording (e.g. record sample interval less than averaging time setting), an AVERAGING ERROR warning will printed at the top of the list or plot.

Averaging Decay or Reverberation Spectra:

A simple means of improving the confidence level of a reverberation measurement is available using the **Record Spectra** function to measure and arithmetically average a number sets of decay spectra prior to processing with the ***Reverberation*** sub-function. Alternatively, each set of decay spectra may be recorded individually and averaged after a separate reverberation readout has been obtained for each set of spectra. In this case, however, the results of each reverberation readout must first be transferred from the last memory to a volatile memory file (see section 4.3.1). As a useful guide, the ISO 3382 – 1975 standard for measurement of reverberation of auditoria, recommends that six sets of spectra covering three separate microphone positions (i.e. two sets per position) are measured and averaged.

Operating Set-Up Parameters:

```
SELECTED SETUP NO.: 0
   FUNCTION              PARAMETER                          VALUE        UNIT
SUBFUNCTIONS:
 21 Reverberation      1 Determination interval    :      -5    -35   dB
```

1–Determination interval: Accepts values between 0 and –120 dB. Sets the upper and lower limit l_u and l_l below the maximum level sampled in each frequency band used for determination of reverberation time. For investigation of reverberation in auditoria in accordance with the ISO 3382 – 1975 standard, –5 to 35 dB upper and lower limits are chosen as the default condition.

4.3.8. *Subtract Spectra* [22] – Sub-Function No: 22

With this sub-function any two 1/1, 1/3 or 1/12 octave spectra or decay spectra of the same type may be subtracted which are stored in the V. Memory. Either the equivalent RMS amplitude (i.e. $antilog_{10}$ *dB level/10*) or the dB level of corresponding frequency bands of the spectra may be subtracted, depending whether arithmetic subtraction or subtraction in dB form is chosen with the Operating Set-Ups described overleaf.

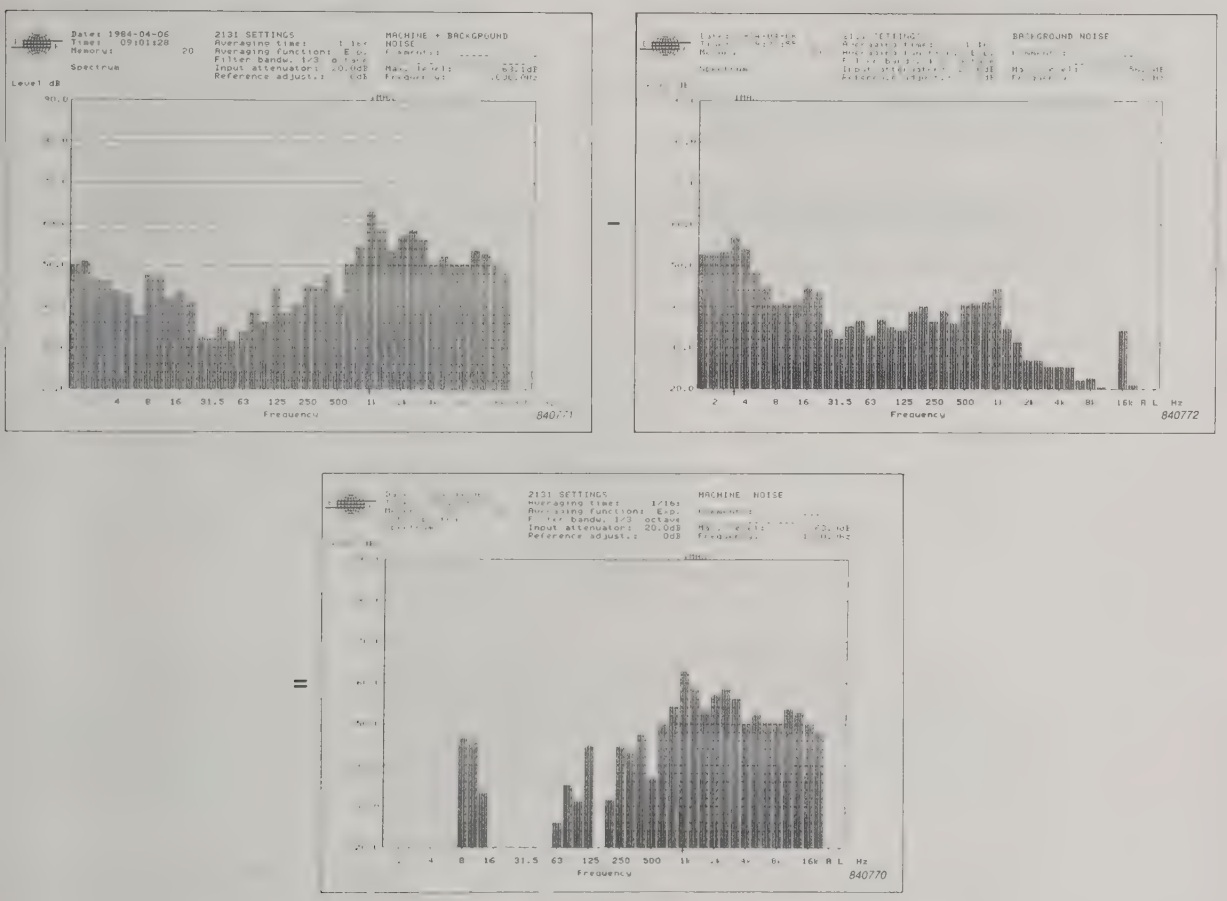
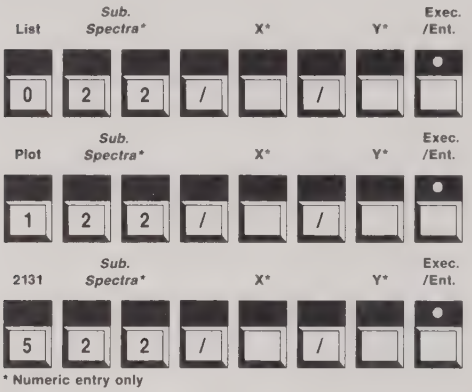


Fig. 4.24. Machine noise spectrum minus background noise spectrum

Practical uses are arithmetic subtraction of unwanted background noise from measurements (see Fig. 4.24), plus dB subtraction of modified spectra for pseudo frequency weighting and integration of spectra (see Fig. 4.25). Where levels below the particular display range selected for recording measurements are encountered they are set to the level corresponding with the base line of the displayed measurement. With arithmetic subtraction negative quantities are treated as 0 dB, whilst with subtraction in dB form they are indicated by a minus sign or a light raster.

Basic Pushkey Commands:

The basic pushkey commands for subtracting one stored measurement from another, are as follows:



Subtacts V. Memory file Y from file X, plus Lists results

Subtacts V. Memory file Y from file X, plus plots results

Subtacts V. Memory file Y from file X, plus displays results on the 2131

* Numeric entry only

On completion of a readout, results are automatically placed in the Last Memory and therefore may be transferred to a V. or C. Memory file to facilitate further processing or reference at a later date.

If one or both of the stored measurements are overloaded then readout will be inhibited and an `Overloaded channel in spectrum` warning printed instead. Where different Analyzer control settings have been used for the measurements, a `Different control settings` warning will be printed in the list or plot, but normally will not influence the accuracy of the readout.

Operating Set-Up Parameters:

```
SELECTED SETUP NO.: 0
   FUNCTION              PARAMETER                          VALUE       UNIT
SUBFUNCTIONS:
 22 Sub. spectra       1 Arithmetical                : YES
```

1–Arithmetical: Accepts logic **Yes** for subtraction in arithmetic form (and default), or **No** for subtraction in dB form. Arithmetic subtracts the equivalent RMS level of the signal amplitudes within corresponding frequency bands, whilst that in dB form operates directly in dB.

Note: Where it is required to subtract a single spectrum from a series of stored spectra, use of the ***Multi Sub.*** subfunction described in section 4.4.2 is recommended.

4.3.9. *Add Spectra* [23] – Sub-function No: 23

In most respects this is similar to ***Sub. Spectra*** described in section 4.3.8, except that it is used to sum any two 1/1, 1/3 or 1/12 octave spectra or decay spectra which are stored in the V. Memory. Either the equivalent RMS amplitude (i.e. $antilog_{10}$ *dB level/10*) or the dB level of corresponding frequency bands of the spectra may be summed, depending on whether arithmetic addition or addition in dB form is chosen with the Operating Set-Ups. In the latter case both negative and positive dB values may be handled, thus enabling inverse frequency weighting characteristics to be built up for pseudo weighting and integration of stored measurements as indicated in Fig. 4.25.

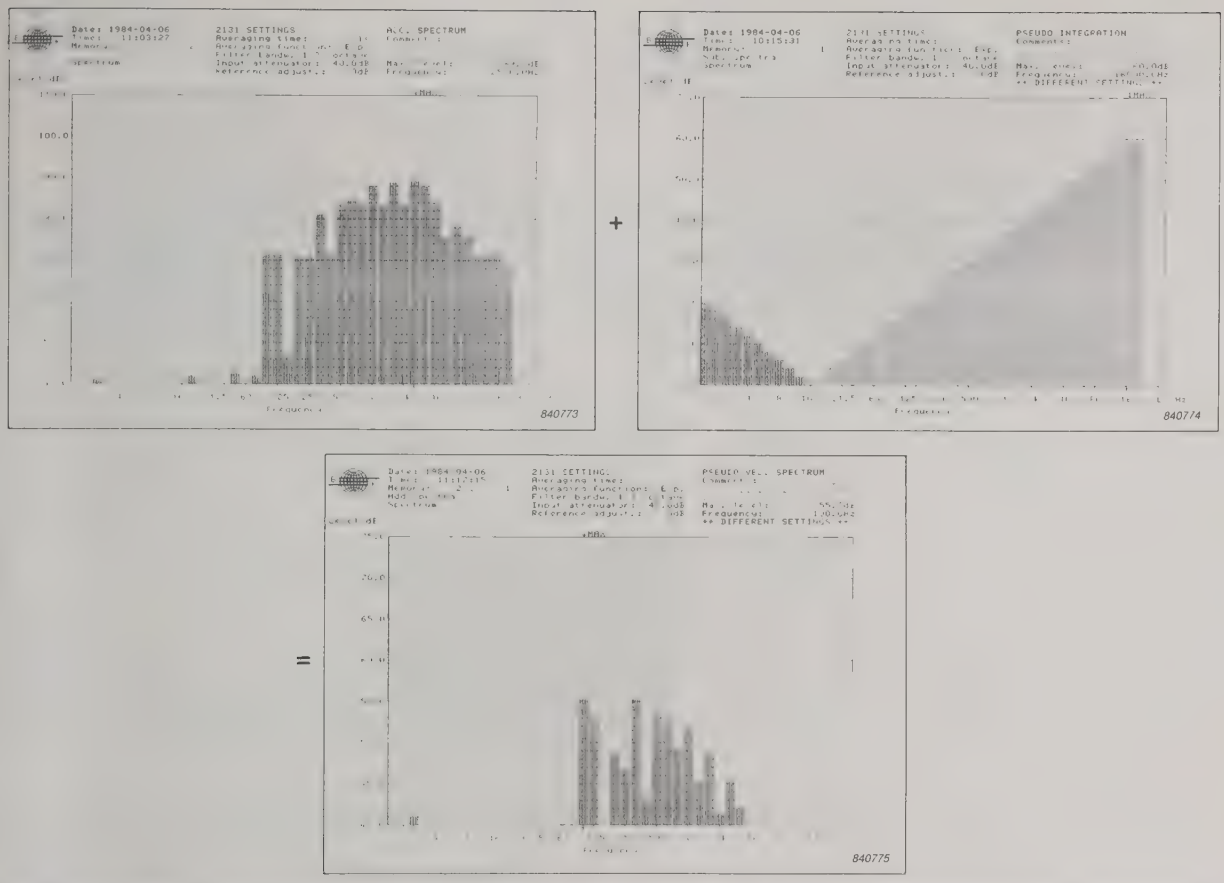
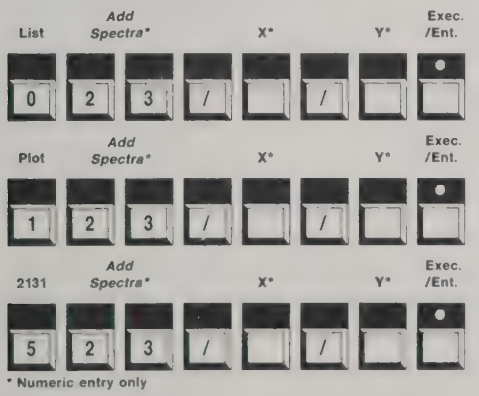


Fig. 4.25. Pseudo integration of a machines vibration spectrum using an inverse frequency weighting to convert vibration acceleration to vibration velocity

Basic Pushkey Commands:



Adds measurement stored in V. Memory file X and Y, plus Lists results

Add measurement stored in V. Memory file X and Y, plus plots results

Adds measurement stored in V. Memory file X and Y, plus displays results on the 2131

On completion of a readout, results are automatically placed in the last memory and therefore may be transferred to a V. or C. Memory file to facilitate further processing or reference at a later date.

If one or both of the stored measurements are overloaded then readout will be inhibited and an `Overloaded channel in spectrum` warning printed instead. Where

different Analyzer control settings have been used for the measurements, a **Different control settings** warning will be printed in the list or plot, but normally will not influence the accuracy of the readout.

Operating Set-Up Parameters:

```
SELECTED SETUP NO.: 0
   FUNCTION                PARAMETER                    VALUE       UNIT
SUBFUNCTIONS:
 23 Add spectra          1 Arithmetical              : YES
```

1–Arithmetical: Accepts logic **Yes** for addition in arithmetic form (and default), plus **No** for addition in dB form. Arithmetic adds the equivalent RMS level of the signal amplitudes within corresponding frequency bands, whilst that in dB form operates directly in dB.

Note: Where it is required to add a single spectrum to a series of stored spectra, use of the ***Multi Add*** sub-function described in section 4.4.2 is recommended.

4.3.10. *7400 File to BZ 7001 File* [24] – Sub-function No: 24

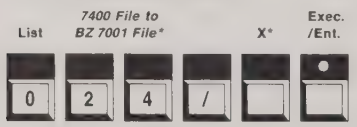
Utilizing this sub-function, conversion of 7400 tape files containing measurements recorded directly from the 2131 is possible. This enables field recorded measurements which have not been previously processed by the 2313 to be documented and stored with the instrument.

As measurements recorded directly from a 2131 include no information on the analyzer control settings, these must be noted by hand at the time of measurement. This is important as on playback of such a measurement, the 2131 must be set to these settings to permit correct conversion by the 2313. This means that it is not possible to convert a 7400 file without including a 2131 in the set-up. However, once a measurement has been converted and re-recorded using the 7400, the 7400 and 2313 can be used alone.

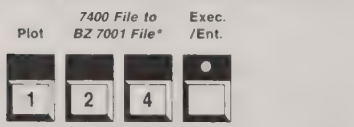
Basic Pushkey Commands:

The basic pushkey sequences for use of the **7400 File to BZ 7001** sub-function are illustrated below.

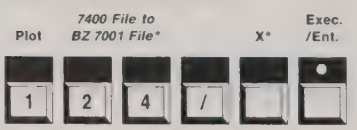
Converts and lists measurement in currently selected 7400 file



Converts and lists 2131 measurement stored in 7400 file X

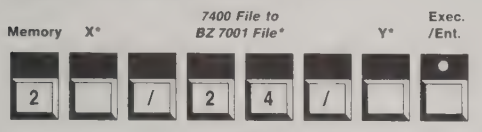


Converts and plots measurement in currently selected 7400 file



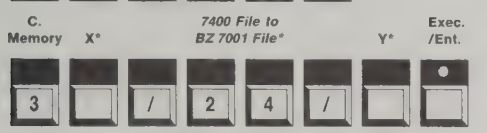
Converts and plots 2131 measurement stored in 7400 file X

Converts and stores 2131 measurement in V. Memory file X from currently selected 7400 file

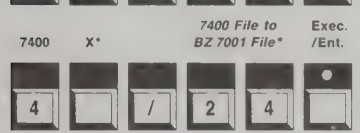


Converts and stores 2131 measurement in V. Memory file X from 7400 file Y

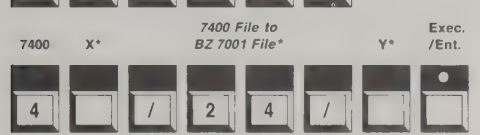
Converts and stores 2131 measurement in C. Memory file X from currently selected tape file



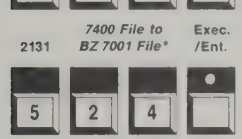
Converts and stores 2131 measurement in C. Memory file X from 7400 file Y



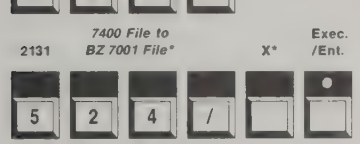
Converts and stores 2131 measurement in 7400 file X from currently selected 7400 file



Converts and stores 2131 measurement in 7400 file X from 7400 file Y



Converts and displays measurement on the 2131 from currently selected 7400 file



Converts and displays measurement on the 2131 from 7400 file X

* Numeric entry only

Where a list and plot is generated, the converted measurement is placed in the Last Memory. Consequently it may be transferred to a V. or C. Memory file for further reference or processing at a later date. See section 4.3.1.

4.4. EXTENDED FUNCTION GUIDE

Due to limited space certain functions and sub-functions are not indicated on the Overlay. These are chosen using two or more separate key strokes as indicated in the following sections. Functions making use of the **Extension [/]** key are termed extended functions and like the main functions may be selected when the **Active LED** of the 2313 is lit.

4.4.1. Trigger [/] [3] – Function No: 13

Trigger is used with the **Record Spectra** function and permits time coincident recording of single events, repetitive test signals etc. It is chosen with aid of the **Set-Up** mode of the 2313 and is enabled immediately **Record Spectra** is activated. When enabled it delays the record sequence until the signal level of a preselected frequency band of the 2131 exceeds one or more of the preset limits specified below.

Where measurement of more than one series of spectra is requested with **Record Spectra**, each series is individually triggered in turn (see Figs. 4.15). This is important for time coincident measurement plus accurate and reliable averaging of repetitive test signals, such as used in determination of reverberation, rise and decay time for example.

Operating Set-Up Parameters:

For selecting the **Trigger** function plus presetting different trigger limits to suit the particular signal investigated, Operating Set-Ups 1, 2 and 3 include the following control parameters:

SELECTED SETUP NO.: 0

	FUNCTION	PARAMETER		VALUE	UNIT
(/ 3)	13 Trig	1 Active	:	NO	
(/ 3)	13 Trig	2 Level	:	0	dB
(/ 3)	13 Trig	3 Time over level	:	0	* 22ms
(/ 3)	13 Trig	4 Decreasing level	:	5	dB
(/ 3)	13 Trig	5 Frequency	:	1000	Hz

1–Active: Accepts logic **Yes** or **No**, with **No** as default. **Yes** selects **Trigger** function.

2–Level: Accepts values between 0 and 120 dB, with default value of 0 dB. It sets the signal level at which triggering is initiated, following which it waits until the specified value of "Decreasing Level" and/or "Time over level" is exceeded before activating the record sequence.

3–Time over level: Accepts values between 0 and 1000 × 22 ms, with default value of 0 × 22 ms., i.e. 0 to 22 s. It determines the time the measured signal must remain above the specified trigger level before recording takes place.

4–Decreasing level: Accepts values between 0 and 120 dB, with default value of 0 dB. It determines the amount the measured signal must fall below its maximum level before recording takes place.

5–Frequency: Accepts values between 0 and 22 000 Hz, with default value of 1 000 Hz. It selects the particular filter centre frequency band employed for triggering. Entry of a decimal value is automatically rounded to the nearest whole number.

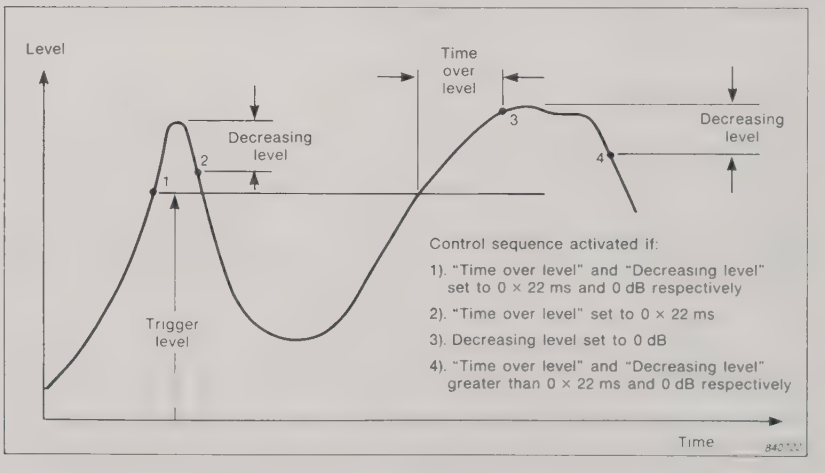
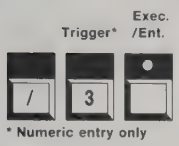

Level
Time over level
Decreasing level
Decreasing level
1
2
3
4
Trigger level
Control sequence activated if:
1). "Time over level" and "Decreasing level" set to 0 × 22 ms and 0 dB respectively
2). "Time over level" set to 0 × 22 ms
3). Decreasing level set to 0 dB
4). "Time over level" and "Decreasing level" greater than 0 × 22 ms and 0 dB respectively
Time

Fig. 4.26. Schematic illustrating use of the **Trigger** *function for triggering on the analyzed level of a repetitive signal*

Besides use with **Record Spectrum**, **Trigger** may be included in an 100 step – automatic control sequence, incorporating other functions of BZ 7001. For this purpose the **Enter Sequence** function is employed as discussed in section 4.4.7, and **Trigger** enabled using the following command:



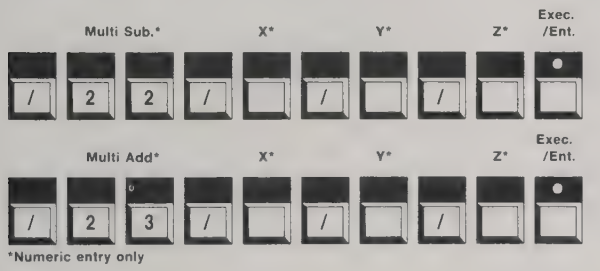
Initiates **Trigger** function

4.4.2. Multi Sub. [/][22] – Extended Function No: 32
Multi Add [/][23] – Extended Function No: 33

These extended functions may be used to add or subtract a single 1/1, 1/3 or 1/12 octave spectrum, or a decay spectrum, from a series of stored measurements. The measurements must be of the same type and have been stored in consecutive volatile memory files of the 2313. Also they must be free of overload and have preferrably been recorded using the same control settings on the analyzer.

Practical uses of the **Multi Sub.** and **Multi Add** functions are in elimination of unwanted background noise from measurements, plus pseudo frequency weighting and integration of measurements. See sections 4.3.8 and 4.3.9.

Basic Pushkey Commands:
The basic pushkey commands for use of the **Multi Sub.** and **Multi Add** functions, are as follows:



Subtracts measurement in V. Memory file Z from files X to Y

Adds measurement in V. Memory file Z to files X to Y

If one or more of the stored measurements are overloaded then summation will be interrupted and an `Overloaded channel in spectrum` error message printed. Similarly, a `Different control settings` warning will be included in the list or plot, where different Analyzer control settings have been employed for recording the measurements. The use of different **Input Attenuator** settings, however, is permissible without influencing the accuracy of results.

Regarding actual addition and subtraction of measurements, either the equivalent RMS amplitude (i.e. $antilog_{10}$ *dB level/10*) or the dB level of corresponding frequency bands are summed. This depends on the parameters set in the current Operating Set-Up (see overleaf). Where levels below the particular display range used for recording measurements are concerned, they are equated to the base line of the displayed measurement. Also, with arithmetic summation negative quantities are treated as 0 dB, whilst with dB summation they are indicated by a minus sign or a lighter raster in the readout.

Operating Set-Up Parameters:

```
SELECTED SETUP NO.: 0
   FUNCTION                PARAMETER                          VALUE      UNIT
SUBFUNCTIONS:
 22 Sub. spectra        1 Arithmetical                : YES
 23 Add spectra         1 Arithmetical                : YES
```

1–Arithmetical: Accepts logic **Yes** for summation in arithmetic form (and default), or **No** for summation in dB form. Arithmetic adds or subtracts the equivalent RMS level of the signal amplitudes within corresponding frequency bands, whilst that in dB form operates directly in dB.

4.4.3. Personal Text [/] [100] – Extended Function No: 110

The **Personal Text** function enables up to 20 characters of text to be entered or edited via the front panel into one or more of the text lines. There are 5 text lines which, if activated in the current Operating Set-Up, appear in the documentation heading of all lists or plots generated by the 2313 (see Fig. 4.27). The inserted text is stored in the continuous memory.

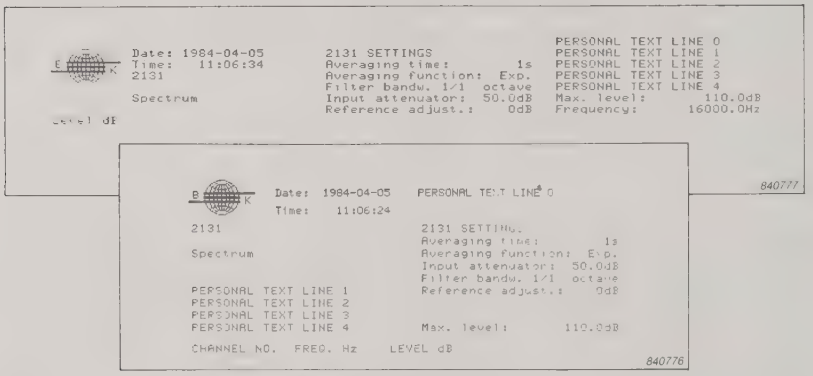


Fig. 4.27. Location of Personal text lines 0, 1, 2, 3 and 4 in the documentation heading of Lists and Plots generated by the 2313

Operating Set-Up Parameters:

The Operating Set-Ups available with the **Personal Text** function are shown below and are for the default case. Note that the Set-Ups are used for enabling or disabling the text. Entering personal text is covered later.

```
SELECTED SETUP NO.: 0
   FUNCTION                PARAMETER                          VALUE      UNIT
SUBFUNCTIONS:
(/100) 110 Personal text      1 Enable line 0               : NO
(/100) 110 Personal text      2 Enable line 1               : NO
(/100) 110 Personal text      3 Enable line 2               : NO
(/100) 110 Personal text      4 Enable line 3               : NO
(/100) 110 Personal text      5 Enable line 4               : NO
```

By selecting **110 Personal Text**, the individual text lines can be enabled or disabled by pressing the **Yes** or **No** pushkey respectively when entering the VALUE in the Set-Up procedure. Note that even if enabled, these text lines will only appear on the **List** read-out if its **"Including heading"** control parameter is enabled. See section 4.2.1.

Entering Personal Text:

Text can be entered and edited in the 5 text lines from 3 sources; over the IEC/IEEE interface (covered in section 6.6.13), over the Serial Interface (covered in section 7.1.2), or via the 2313 front panel.

Text is entered via the front panel by first selecting either the "Number" or "Character" mode.

Character Mode:

In the "Character" mode, the decimal equivalent of the ISO character is entered, separated by a **[/]** key push. The characters available with their decimal equivalents are given in Table 4.4. Note that numbers can also be entered in the character mode by entering their decimal equivalent.

No.	Char.	No.	Char.	No.	Char.	No.	Char.	No.	Char.	No.	Char.	No.	Char.	No.	Char.
0	Δ	16	π	32	SP	48	0	64	@	80	P	96	`	112	p
1	α	17	∫	33	!	49	1	65	A	81	Q	97	a	113	q
2	²	18	æ	34	"	50	2	66	B	82	R	98	b	114	r
3	Σ	19	σ	35	#	51	3	67	C	83	S	99	c	115	s
4	δ	20	τ	36	$	52	4	68	D	84	T	100	d	116	t
5	ε	21	ü	37	%	53	5	69	E	85	U	101	e	117	u
6	φ	22	√	38	&	54	6	70	F	86	V	102	f	118	v
7	ω	23	–	39	'	55	7	71	G	87	W	103	g	119	w
8	Ω	24	↑	40	(	56	8	72	H	88	X	104	h	120	x
9	⁰	25	↓	41	)	57	9	73	I	89	Y	105	i	121	y
10	₀	26	→	42	*	58	:	74	J	90	Z	106	j	122	z
11	Ø	27	←	43	+	59	;	75	K	91	[	107	k	123	{
12	λ	28	¯	44	,	60	<	76	L	92	\	108	l	124	|
13	μ	29	_	45	–	61	=	77	M	93	]	109	m	125	}
14	±	30	|	46	.	62	>	78	N	94	^	110	n	126	~
15	■	31	|	47	/	63	?	79	O	95	_	111	o	127	DEL

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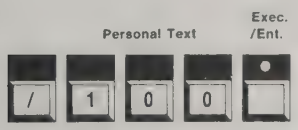
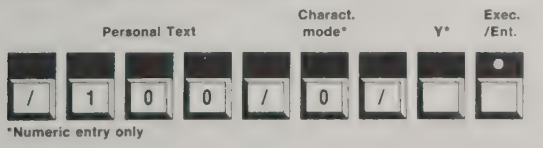
Table 4.4 List of personal text characters available with numbers used when writing the characters in the "Character" mode

The pushkey commands for accessing the "Character" mode are as follows:



Selects Personal Text "Character" mode – text line 0



Selects Personal Text "Character" mode – text line Y where $0 \leqslant Y \leqslant 4$

Once the "Character" mode has been selected using one of the above pushkey sequences, the text in the selected text line can be inserted or edited by using the key commands listed in Table 4.5.

Pushkey Label	Effect
Help	Print selected text line
Exec./Ent.	Stop
/	Move to next character position
Clear Entry	Clear selected text line and return to first character position
0 to 127	Write (or overwrite) character according to Table 4.4
–	Delete character and move to next character position
.	Return to first character position
E	Move to previous character position

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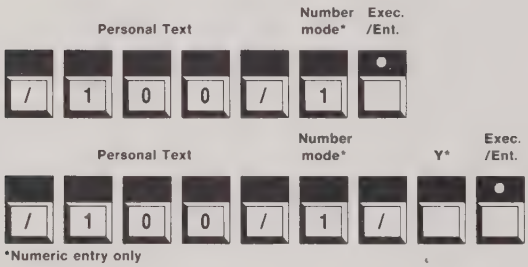
Table 4.5. Commands when operating in Personal Text "Character" mode

Number Mode:

In the "Number" mode, the numbers '**0**' to '**9**', '**E**' and '**.**', as printed on the pushkeys, are entered directly. The pushkey commands for accessing the "Number" mode are as follows:


Personal Text
Number mode*
Exec. /Ent.
/ 1 0 0 / 1
Selects Personal Text "Number" mode – text line 0
Personal Text
Number mode*
Y*
Exec. /Ent.
/ 1 0 0 / 1 /
Selects Personal Text "Number" mode – text line Y where 0≤Y≤4
*Numeric entry only

Once the "Number" mode has been selected using one of the above pushkey sequences, the text in the selected text line can be inserted or edited by using the key commands listed in Table 4.6.

Pushkey Label	Effect
Help	Print selected text line
Exec./Ent.	Stop
/	Move to next character position
Clear Entry	Clear selected text line and return to first character position
0 to 9, –, . , E	Write (or overwrite) with number

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Table 4.6. Commands when operating in the Personal Text "Number" mode

4.4.4. Execute 7400 Program [/] [101] – Extended Function No: 111

This function loads the 2313 with a B&K "soft-function" program from the 7400 Digital Cassette Recorder and then executes it like a normal function. Soft-functions permit new documentation and measurement functions to be added to suit more specialised applications, and will be available at a later date from the B&K Software Department. Please contact your local B&K representative for details.

Basic Pushkey Command:

The pushkey command for loading and/or executing a stored soft-function program is as follows:

Loads and executes soft-function from 7400 file X

where X is the tape file number allocated by the 7400, and Y and Z are the parameter values indicated in the literature accompanying the soft-function. Where no parameters are indicated, Y and Z can be ignored.

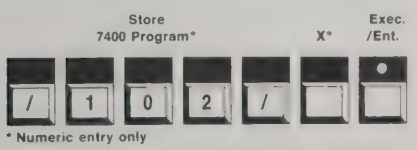
When loaded the soft-function is stored in a special volatile memory file and then executed. Only one soft-function may be stored at a time and it is retained up until time the 2313 is switched off or when another function is executed which requires the use of this file (e.g. where a large number of averages are performed with the **Record Spectra** function). If required the stored function can be executed a second or third time, simply by repeating the above command. Any attempt to load and execute a 7400 file not containing a soft-function will return the 2313 to standby, plus print an `Error in code for function` message.

4.4.5. Store 7400 Program [/] [102] – Extended Function No: 112

This function enables a work copy to be made on the users own tape, of a soft-function program which has been previously loaded in the 2313 using the **Execute 7400 Program** function (see section 4.4.4).

Basic Pushkey Command:

The pushkey command for storing a program on 7400 tape is as follows:



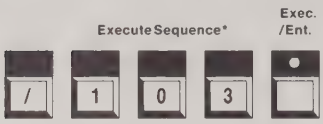
Copies soft-function in 7400 file X from the 2313

4.4.6. Execute Sequence [/] [103] – Extended Function No: 113

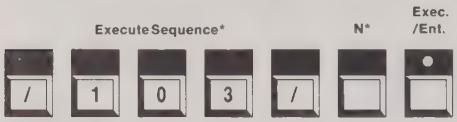
This function executes a pushkey sequence, previously entered and stored in the continuous memory using the **Enter Sequence** function in section 4.4.7. If the sequence contains one or more illegal or non existent functions and parameters, it will be terminated and an appropriate error message printed. It is not possible to activate the sequence via the IEC Interface of the 2313 or store it using an external medium such as the 7400.

Basic Pushkey Command:

The pushkey commands for executing a stored pushkey sequence are as follows:



Executes once, a key push sequence stored in the 2313



Executes "N" times, a stored key push sequence, where $0 \leq N \leq 29999$

* Numeric entry only

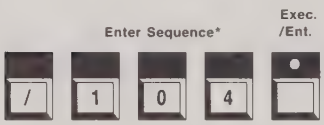
Two examples showing the use of **Execute Sequence**, are given in section 4.4.7.

4.4.7. Enter Sequence [/] [104] – Extended Function No: 114

Enter Sequence enables the user to enter a pushkey sequence containing up to 100 key pushes. This allows an automatic control sequence to be developed which can be executed using the **Execute Sequence** function described in section 4.4.6. All key pushes are saved in the continuous memory, except **Reset** which ends entry of a sequence. If required the sequence can be edited using the **Edit Sequence** function described in section 4.4.8. Entry of a pushkey sequence via the IEC Interface of the 2313 is not possible.

Basic Pushkey Command:

The pushkey command for entering a pushkey sequence is as follows:



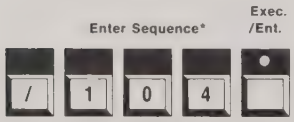
The following key pushed are saved by the 2313 until **Reset** is pressed

* Numeric entry only

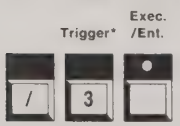
Examples of Use:

To illustrate the use of the **Enter Sequence** function, two examples are given. The first gives a key push sequence for automatic storage and documentation of a single 1/1 or 1/3 octave measurement when the analyzed signal exceeds the preset limits set with the **Trigger** function of the 2313.

1. Entry and storage of automatic control sequence:



Initiates **Enter Sequence** function for entry and storage of the following key push sequence



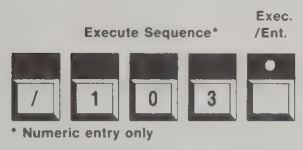
Initiates **Trigger** function (see section 4.4.1)

When triggered, saves 2131 spectrum in V. Memory file 0

Command to retrieve last measurement and plot result

Terminates **Enter Sequence** function, storing the above key push sequence

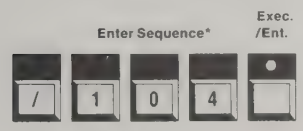
2. Execution of stored key push sequence:



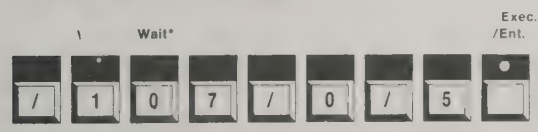
Executes stored sequence once

As the second example (see below) a key push sequence for automatic recording of spectra into consecutive 7400 tape files is given. The measurement sequence starts at 9.45 am and is repeated at 5 minute intervals with aid of the **Wait Clock** and **Wait** functions of the instrument. After the first execution the **Wait Clock** time is ignored. Also shown are use of the **Relay On** and **Relay Off** functions for automatic switching of the test source.

1. Entry and storage of automatic control sequence:

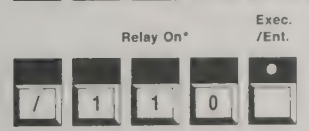


Initiates **Enter Sequence** function for entry and storage of the following key push sequence

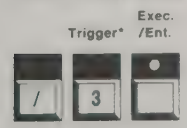


Delay for repeating sequence at 5 minute intervals (see section 4.4.10)

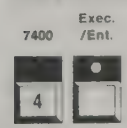
Delay for repeating sequence at 5 min. intervals (see section 4.4.10)



Activates test source via the **Remote Control** socket of the 2313 (see section 4.4.12)



Initiates **Trigger** function (see section 4.4.1)

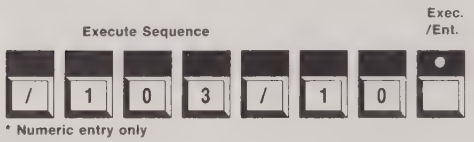


When triggered, records measurement in currently selected 7400 tape file from the 2131

Deactivates test source (see section 4.4.12)

Terminates **Enter Sequence** function, storing the above key push sequence

3. Execution of stored key push sequence:



Executes stored sequence 10 times, recording results in 10 consecutive tape files

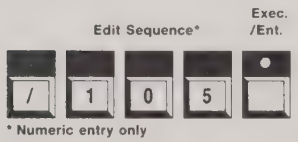
The above example makes use of the fact that the 7400 automatically increments the tape file number, i.e. it automatically stations the tape at the start of the next tape file after recording each measurement. To perform a similar operation with the V. or C. Memory of the 2313, the file number has to be incremented using the **Shift** function described in section 4.4.9.

4.4.8. Edit Sequence [/] [105] – Extended Function No: 115

This function enables editing of a pushkey sequence, whereby individual key pushes can be changed, inserted or deleted. The sequence is entered and stored in the continuous memory using the **Enter Sequence** function in section 4.4.7.

Basic Pushkey Command:

The pushkey command for editing a pushkey sequence is as follows:



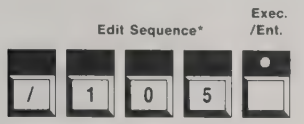
Enables stored sequence to be edited according to Table 4.7 until **Exec./Ent.** is pressed to stop editing

Pushkey Label	Effect
Help	List sequence
〈0 to max.〉 〈Exec./Ent.〉	Select keypush line number
/ 〈Keypush〉	Insert 〈Keypush〉 in selected line number
–	Delete keypush
	Select next keypush line
E	Select previous keypush line
Exec./Ent.	Stop

Table 4.7 Commands when operating in the **Edit Sequence** *Mode*

Example of Use:

For changing the **Wait Clock** time given in the **Enter Sequence** example from 9.45 to 9.40 am (see section 4.4.7), one must first select the appropriate line, delete it and then insert a new line in place of it. The procedure for doing this is as follows:



Selects the **Edit Sequence** modes, providing printout of the commands given in Table 4.7.

Selects line number 8 of the stored sequence, printing 8 5

Deletes the selected line, printing its new contents, i.e. 8 EXECUTE in this case

Inserts 0 into line 8, giving a print out of the line, i.e. 8 0

Ends the **Edit Sequence** mode

4.4.9. Shift Function [/] [106] – Extended Function No: 116

As discussed at the start of section 4.2 and in subsequent sections, the **Exec./Ent** key may be used to repeat execution of certain functions plus automatically update their parameters. For carrying out the same operation with a stored key push sequence, however, a separate function termed **Shift** must be employed. This is intended for direct inclusion in a key push sequence stored with the **Enter Sequence** function and serves to fetch a function plus increment its parameter each time the sequence is executed.

Besides allowing information to be stored in or recalled from successive memory or tape files, the **Shift** function enables a stored key push sequence to used for a number of separate tasks simply by entering a new function prior to executing the sequence. It is, however, only possible to fetch a single function at a time, whose parameter is to be incremented.

Basic Pushkey Command:

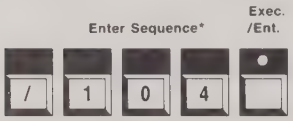
The pushkey command for executing the **Shift** function is as follows:

Retrieves a function, plus increments its parameter

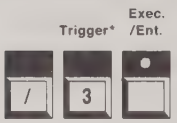
Examples of Use:

The usefulness of the **Shift** function can be clarified by the following example. This gives the key push sequence for recording a series of spectra in the V. Memory of the 2313, displaying their 800 Hz frequency band time history on the 2131 and storing this in the C. Memory of the Recorder. The sequence is repeated 10 times and is useful for investigation of vehicle passby and aircraft flyover noise.

1. Entry and storage of key push sequence for retrieving and incrementing the function initiated in item 2 below.

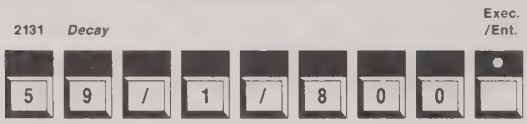


Initiates **Enter Sequence** function for entry and storage of the following key push sequence

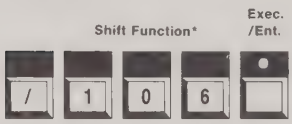


Initiates **Trigger** function (see section 4.4.1)

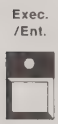
When triggered, records series of measurements from the 2131 in V. Memory files 1 to 39



Displays 800 Hz band decay of measurement series from V. Memory files 1 – 39



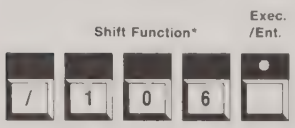
Enters **Shift** command, to fetch and increment the **C. Memory** function defined in item 2.



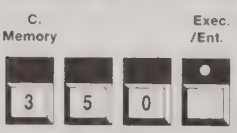
Commands execution of function defined in item 2

Terminates **Enter Sequence** function, storing the above key push sequence

2. Entry of function to be incremented:

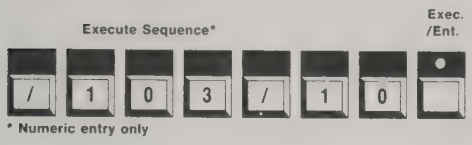


Initiates **Shift** function, for retrieving and incrementing the following function



Stores dummy spectrum in C. Memory file 50, plus series of decay spectra starting at file 51

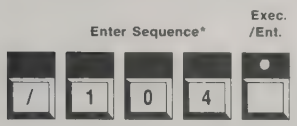
3. Execution of stored sequence and incremented function:



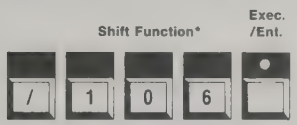
Executes sequence 10 times, storing successive decay spectra in C. Memory files 51 to 60

As a second example, the method of saving individual spectra in successive V. Memory and 7400 files is given.

1. Entry and storage of key push sequence for retrieving and incrementing the function initiated in item 2 below.



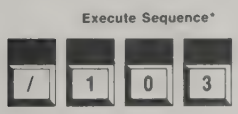
Initiates **Enter Sequence** function for entry and storage of the following key push sequence



Enters **Shift** command, to fetch and increment the function defined in item 2.

Commands execution of function defined in item 2

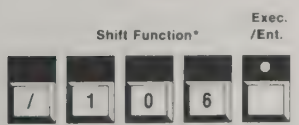
Command to retrieve last measurement result and store it in the correct 7400 file



Enters command to repeat the above key push sequence

Terminates **Enter Sequence** function, storing the above key push sequence

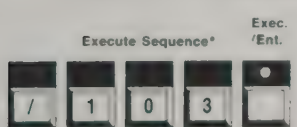
2. Entry of function to be incremented:



Initiates **Shift** function, for retrieving and incrementing the following function

Stores 2131 spectrum in Memory file 0

3. Execution of stored sequence and incremented function:



Executes stored key push sequence, storing 2131 spectrum in Memory file 1 and 7400 file 1

Stores new 2131 spectrum in V. Memory file 2 and 7400 file 2

etc.

Stores new 2131 spectrum in V. Memory file "n+1" and 7400 file "n+1"

Note: Pressing the **Reset** key either just before or during execution of a stored key push sequence, will delete the function to be incremented. In order to re-execute the sequence afresh, one must repeat entry of the function to be incremented, i.e. repeat items 2 and 3.

4.4.10. Wait [/] [107] – Extended Function No: 117

When a time is entered and this function is executed as part of a 100-step key push sequence (see section 4.4.7), the 2313 waits until the actual clock time is an exact multiple of the inserted time in seconds before continuing with the sequence.

Example 1: If 1 hour is inserted as the wait time and the clock is at 8:45:15 the 2313 will wait until 9:00:00 (i.e. 1 hour × 9) before executing the sequence. If the sequence is repeated it will be re-executed at 10:00:00 (i.e. 1 h × 10), 11:00:00 (i.e. 1 h × 11), etc.

Example 2: If 18 minutes is inserted as the wait time and the clock is at 00:59:10 the 2313 will wait until 01:12:00 (i.e. 18 minutes × 4) before executing the sequence. If the sequence is repeated it will be re-executed at 01:30:00 (i.e. 18 m × 5), 01:48:00 (i.e. 18 m × 6), etc.

Example 3: If 1 minute 40 seconds (i.e. 100 s) is inserted as the wait time and the clock is at 10:40:20 the 2313 will wait until 10:41:40 (i.e. 100 s × 3845) before executing the sequence. If the sequence is repeated it will be re-executed at 10:43:20 (i.e. 100 s × 3846), 10:45:00 (i.e. 100 s × 3847), etc.

Utilising **Wait** in a key push sequence, allows time for a function to be completed before continuing to the next step. In addition, it ensures functions are initiated at regular time intervals independent of the time it takes to execute the function.

Basic Pushkey Command:

The pushkey command for inserting the wait time is as follows:

where H is the number of hours (0 to 23), M is the number of minutes (0 to 59) and S is the number of seconds (0 to 59).

An example, illustrating the use of the **Wait** function, is given in section 4.4.7.

4.4.11. Wait Clock [/] [108] – Extended Function No: 118

When a time is entered and **Wait Clock** is executed as part of a 100-step key push sequence, the 2313 waits until the entered time corresponds with the 2313 clock time before continuing with the sequence. A further feature is that if this function is repeated with the same time as previously used, this function is ignored. This enables a sequence to be performed a number of times where the 2313 waits for the clock the first time only. The key push sequence can be entered using **Enter Sequence** or edited using **Edit Sequence**. See sections 4.4.7 and 4.4.8 respectively.

Basic Pushkey Command:

The pushkey command for inserting the wait clock time is as follows:

where H is the number of hours (0 to 23), M is the number of minutes (0 to 59) and S is the number of seconds (0 to 59).

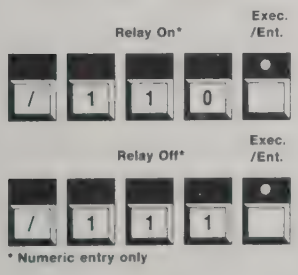
An example, illustrating the use of the **Wait Clock** function, is given in section 4.4.7.

4.4.12. Relay On [/] [110] – Extended Function No: 120
Relay Off [/] [111] – Extended Function No: 121

These are for inclusion in a 100-step key push sequence and permit remote switching of external equipment coupled to the **Remote Control** socket on the rear panel of the 2313. For example, by employing **Relay On** and **Relay Off** together with the **Wait Clock** and **Wait** functions an automatic control sequence may be developed which automatically switches on or off an external noise source at a preset time or time interval (see section 4.4.7). Alternatively, they may be employed with the **Trigger** function to activate an audible alarm when the measured signal exceeds a preset trigger level.

Basic Pushkey Command:

The pushkey commands for activating **Relay On** and **Relay Off**, are as follows:



Opens relay contacts,
switching on B&K Noise Source

Closes relay contacts,
switching off B&K Noise Source

Relay On is factory preset to open circuit pins 2 and 5 of the **Remote Control** socket (see Fig. 2.5), while **Relay Off** interconnects them. This is directly suited for switching on and off the B&K Sound Power Source Type 4205 and Noise Source Type 4224 which may be coupled to the 2313 using a standard 8 pin DIN Cable AQ 0034. For switching the B&K Noise Generator Type 1405, a 8 to 7 pin DIN cable is used which has to be made up individually. Please consult the 1405 Instruction Manual.

For use with other external equipment which require a make/break connection for activation and deactivation, **Relay On** and **Relay Off** can be modified accordingly. This is done by carefully easing off the **Remote Control** socket lead from the interface board pin J8 shown in Fig. 4.28 and fitting it to pin J9 indicated. The interface board is mounted on the rear panel and is accessible on sliding off the top panel which is fastened by two screws on the back of the instrument. Before attempting to release the top panel ensure that the 2313 is disconnected from the mains supply.

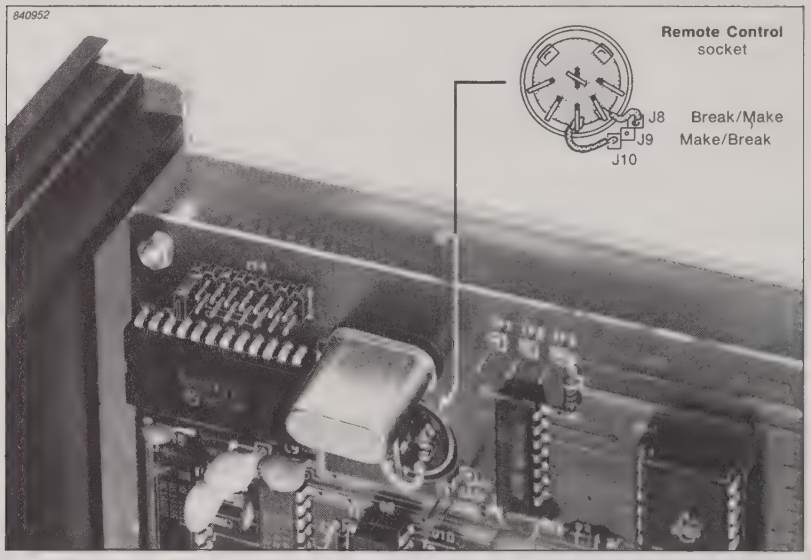


Fig. 4.28. **Relay On – Relay Off** *connections on the digital interface board of the 2313*

4.5. COMMON FUNCTION GUIDE

Common functions are chosen using the Operating Set-Ups of the 2313 (see section 3.9) and once enabled are automatically executed in parallel with most of the main documentation and storage functions of the apparatus

4.5.1. Add Lin. and "A"-Weight – Common Function No: 200

This function determines the Linear and "A"-Weighted level of a displayed measurement and once selected with the current Operating Set-Up is automatically executed each time the **List**, **Plot**, **V. Memory**, **C. Memory** or **Record Spectra** function is activated. Following determination of the Linear and "A"-weighted level, the result is included in the readout or stored together with other data related to the measurement.

Provided that **Lin. and "A"-Weight** is chosen prior to recording a 1/1, 1/3 or 1/12 octave measurement, then all subsequent lists and plots of the measurement will include this information, regardless of whether **Lin. and "A"-Weight** remains selected or not. For determination of the linear and "A"-weighted levels of stored measurements lacking this information, the measurements can be readback to the 2131 using the **2131** function, and then either stored or documented with the **Lin. and "A"-Weight** function selected.

Determination of the linear and "A"-weighted level is based summing the RMS level of each 1/1 or 1/3 octave frequency band. This is done in accordance with ISO 3741 Standard for determination of the sound power of noise sources and for the majority of

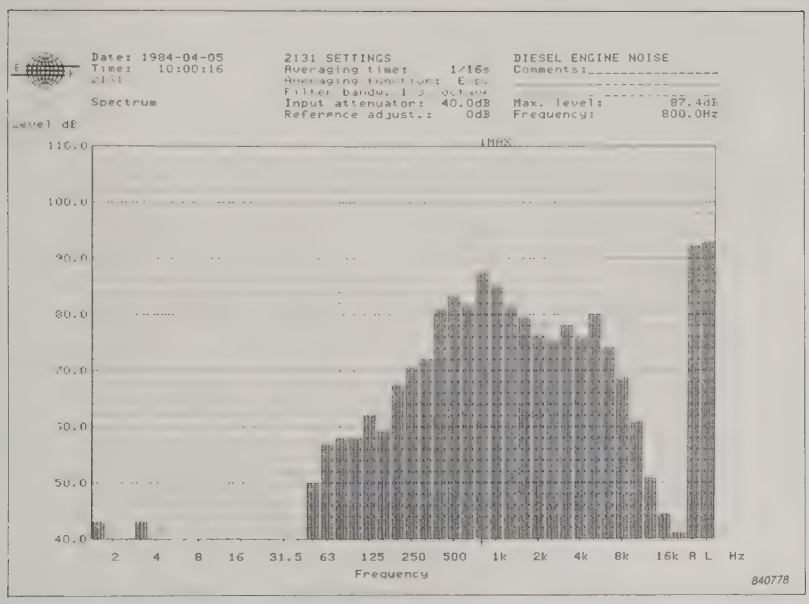


Fig. 4.29. Readout of Lin and "A"-Weighted levels with plot generated by the 2313

signals is within the accuracy and tolerance limits stated. However, where very low level – low frequency signals are measured, the accuracy will be reduced. This is because it is assumed that the minimum level is never less than that corresponding with base line of the analyzers display. In such cases it is always better to use the Linear and "A"-weight functions of the 1/1 octave measurement mode of the 2131, rather than that built-in the 2313.

Operating Set-Up Parameters:

```
SELECTED SETUP NO.: 0

COMMON SETUP:
200 Add Lin and A      1 Lin and A weight channel  : NO
```

1–Lin and A-weight: Accepts logic **Yes** or **No**, with **No** as default. **Yes** enables the linear and "A"-weight function of the 2313, disabling readout of the Lin. or "A"-weight channel chosen with the 1/1 octave mode of the 2131.

Note: Lin. and "A"-Weight determination with the 2313 is disabled if an Expansion Unit Type 5765 or Extension Unit WH 0490 is employed with the 2131.

4.6. BZ 7001 ERROR CODES

ERROR NO: 0

Paper drive and printing are inhibited. Fit new paper roll to restore normal operation.

Note: If the paper drive remains inhibited, the alignment of the paper sensor should be checked. See the separate Service Manual for the 2313

ERROR NO: 1	Attempt to alter Default Set-Up No: 0. Is possible with Operating Set-Ups No: 1, 2 and 3 only.
ERROR NO: 2	Attempt to enter clock data outside acceptable limits. Acceptable values are: Year: 1900 to 9999 Month: 1 to 12 Day: 0 to 31 Hours: 0 to 23 Minutes: 0 to 59
ERROR NO: 3	Non existent Set-Up., i.e. Set-Up No: greater than 3
ERROR NO: 4	Non existent Function., i.e. Function No: greater than 121
ERROR NO: 5	Non existent Parameter, i.e Parameter No: greater than that available with the particular function chosen. See Function and Parameter list.
ERROR NO: 6	Parameter value outside limits indicated by accompanying error message.
ERROR NO: 7	Error in character input. Not used with BZ 7001.
ERROR NO: 8	No room for saving measurement in C. Memory. If the measurement is newly generated one, it may be recalled from the Last Memory. See section 4.3.1.
ERROR NO: 9	Attempt to save measurement exceeding maximum file number of C. Memory. If the measurement is newly generated one, it may be recalled from the Last Memory. See section 4.3.1.
ERROR NO: 10	Attempt to read V. or C. Memory file (or activate 100 step control sequence) that does not exist. For file listing, activate **Menu** plus either the **V. Memory** or **C. Memory** function.
ERROR NO: 11	No room for saving measurement in V. Memory. If the measurement is newly generated one, it may be recalled from the Last Memory. See section 4.3.1.
ERROR NO: 12	Attempt to save measurement exceeding maximum file number of C. Memory. If the measurement is newly generated one, it may be recalled from the Last Memory. See section 4.3.1.
ERROR NO: 13	Function requiring a processing capability outside the range of the working memory. For example, for recording a series spectra the maximum number of spectra which may be stored depends on whether averaging is selected or not. See section 4.2.10.
ERROR NO: 14	Attempt to save measurement in a stored–secured V. or C. Memory file already containing a measurement. If the measurement is newly generated one, it may be recalled from the Last Memory. See section 4.3.1.
ERROR NO: 15	Attempt to delete a V. or C. Memory file safeguarded by the Delete–Secured function. See sections 4.2.3 and 4.2.7.

ERROR NO: 16	Attempt to activate a function via the IEC interface without first assigning control to the interface of the 2313 or entering the appropriate parameter values for the function. See chapter 6.
ERROR NO: 17	Error in IEC data – not applicable with BZ 7001
ERROR NO: 18	Job specification error in data input to the IEC Interface of the 2313., i.e. non existent function or parameter formatting error.
ERROR NO: 19	IEC Time Out. No communication via the IEC interface or communication interrupted for a period lasting 5 seconds or more. Normally indicates minor fault with external equipment and/or connection of equipment not suited for use with BZ 7001. Check all interface cable connections, plus Power and Address Switch settings.
ERROR NO: 20	Attempt to read tape file not originating from the 2313. For processing of measurements recorded directly from the 2131 or 3360 without a 2313 in the setup, use of the **7400 File to BZ 7001 File** function is recommended.
ERROR NO: 21	Tape read error, caused by tape drop out, for example.
ERROR NO: 22	Attempt to read beyond last file present on tape. Normally occurs if non existent tape file named.
ERROR NO: 23	Attempt to save or read beyond end of tape.
ERROR NO: 24	Not used with BZ 7001
ERROR NO: 25	No cassette inserted and/or lid of tape compartment not closed
ERROR NO: 26	Substitution of tape file with memory file of the 2313 is not possible on account of different file sizes.
ERROR NO: 27	Attempt to overwrite or delete a write–protected Digital Tape Cassette.
ERROR NO: 28	Attempt to read incomplete tape file, the end of which has been damaged or accidently deleted during manual operation of the 7400.
ERROR NO: 29	Attempt to read a 7400 tape file not containing a soft function. To help locate the correct file, activate **Menu** plus **7400**. See section 4.2.8.
ERROR NO: 30	Error in tape file number when reading spectra recorded with the 7400 without a 2313 in the analysis set-up. During recording the 7400 allocates the file number which if not the same as that on which tape is stationed during reading, will result in a error message.
ERROR NO: 31	File substitution not possible due to the file substitution option fitted to the 7400. Refer to literature accompanying the 7400 option.
ERROR NO: 32	Illegal function or combination of functions. For example, use of List with Simult. file, Modify Spectrum with 7400 file, Plot Spectra with files not of same type, Decay List or Plot of non existent frequency band. Check if relevant pushkey sequence has been used.

ERROR NO: 33	Execution of stored pushkey sequence not possible., i.e. sequence contains one or more illegal or non existent functions and parameters.
ERROR NO: 34	Wrong type of memory file for particular function requested. Use of C. Memory file instead of V. Memory file, for example.
ERROR NO: 35	Parameter value outside accepted limits. Press **Help** for details of value entered.
ERROR NO: 36	Execution of function not possible on account of incorrect series file interval. For file listing, activate **Menu** and either the **V. Memory** or **C. Memory** function.
ERROR NO: 37 to ERROR NO: 103	Not used with BZ 7001
ERROR NO: 104	One or more files of wrong data type., i.e. a mixture of 1/3 octave,
ERROR NO: 104	One or more files of wrong data type., i.e. a mixture of 1/3 octave, 1/1 octave files etc. Remember only files of the same data type may be processed using the **Reverberation**, **Decay**, **Plot Spectra** functions etc.
ERROR NO: 105	Too long a time interval between spectra recorded for determination of reverberation time. Rerecord the spectra using a shorter spectrum sample interval. See section 4.2.10.
ERROR NO: 106	Not enough data for determination of reverberation time., i.e. larger number of spectra required.
ERROR NO: 107	Tape file originating from an Application Package other than BZ 7001. Replace BZ 7001 with appropriate Application Package.
ERROR NO: 108	Function cannot be performed due to overload of one or more measurement channels. Increase Input Attenuator range on Analyzer to resume operation without overload.
ERROR NO: 109	Results outside accepted limits of –99 to 300 dB. Is used for addition and subtraction of spectra only.
ERROR NO: 110	Series of spectra for reverberation or decay measurements is not complete. Only spectra recorded with the **Record Spectra** function can be handled and must be recorded as one complete set of consecutive files. They cannot be recorded individually or split into a number of sets.
ERROR NO: 111	Attempt to convert 7400 file to BZ 7001 file which has already been correctly formatted by BZ 7001. Use **7400** function instead of **7400 File to BZ 7001 File**.

5. USE WITH OTHER DIGITAL FREQUENCY ANALYZERS

5.1. USE WITH SOUND INTENSITY ANALYZING SYSTEM TYPE 3360

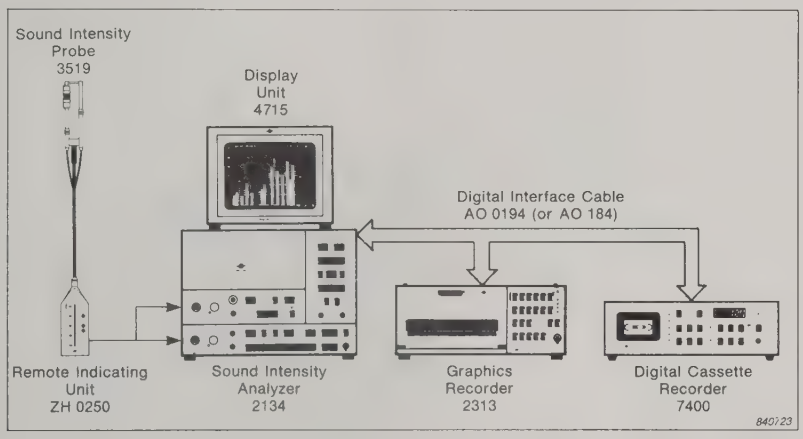


Fig. 5.1. Use of the 2313 Graphics Recorder with the 3360 Sound Intensity Analyzing System and the 7400 Digital Cassette Recorder

Besides use with Digital Frequency Analyzer Type 2131, the Application Package BZ 7001 may be employed with the Digital Frequency Analyzer Type 2134 of the Sound Intensity Analyzing System Type 3360. In many respects the two Analyzers are very similar and therefore provided that the 2134 is initially set-up and operated in the same way as described for the 2131 (see sections 4.1 to 4.5), the complete range of BZ 7001 functions may be utilized with 3360. There are however a few basic limitations be taken into account, concerning documentation and summation of sound pressure and sound intensity measurements with BZ 7001.

- The **Sound Intensity** and **Sound Pressure** ("Channel A" and "Channel B") control settings are not indicated in the documentation heading of the readout. However, they are retained along with other control settings information when measurements are stored using the 2313 or displayed on the 2134.

- When the **Add Spectra/Sub. Spectra**, **Multi Add/Multi Sub. or Lin and "A"-Weight** functions of BZ 7001 are utilized, "negative" values of sound intensity in each 1/1 or 1/3 octave frequency band are treated as positive values.

For majority of applications these limitations are of minor importance, but can be avoided using the 2313 together with Application Package BZ 7004. This is especially designed for use with the 3360 and includes some of the main functions of BZ 7001, plus others for measurement and readout of sound power spectra, contour and 3D-plots etc. Also 3360 measurements stored with BZ 7001 may be handled by BZ 7004 as if transmit-

ted directly by the 3360 so that there is no loss of information. For further details on Application Package BZ 7004, the specifications section of chapter 1 should be consulted.

5.2. USE WITH SIGNAL ANALYZERS TYPES 2032 AND 2034

As with other Application Packages available for the 2313, BZ 7001 is capable of producing hard-copy graphic plots of measurements presented on the display screen of the Dual Channel Signal Analyzers Types 2032 and 2034. Each copy takes approximately 10 seconds to produce and is fully annotated so that there are no control settings to note.

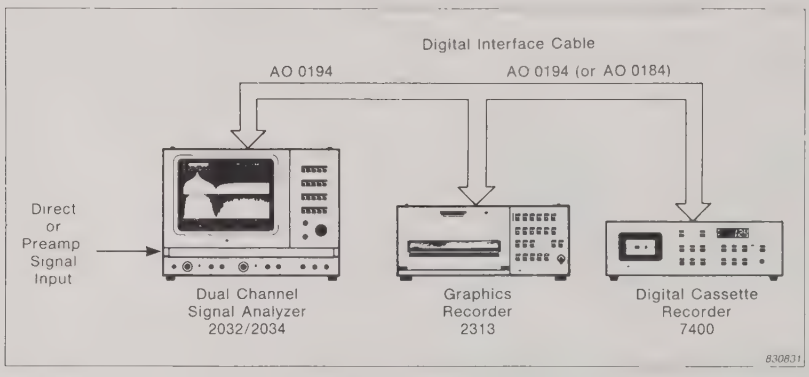


Fig. 5.2. Use of the 2313 Graphics Recorder with a 2032 or 2034 Dual Channel Signal Analyzer plus 7400 Digital Cassette Recorder

Interconnection and initial setting up of the recording and analysis equipment is similar to that described in section 4.1, except that "Interface Controller – Not Active" mode must be selected using the **Address Switch** of the 2313. This disables local front panel activation of the documentation, storage and measurement functions designed for 2131 Frequency Analyzer, enabling the 2313 to serve as a conventional dot-matrix printer when its **Reset** plus **Exec./Ent.** keys are pressed. A hard copy of the measurement displayed on the 2032 or 2034 may then be obtained simply by pressing the **Digital I/O** "Plot" key of the Analyzer.

By including a 7400 Digital Cassette Recorder in the setup (see Fig.5.2), simultaneous recording and storage of measurements is possible. Alternatively, where it is required to confine readout to only one instrument at a time, then either the 2313 or 7400 may be deactivated by pressing their **Reset** or **Stop** key.

Note: Although 2032 and 2034 **Digital I/O** "Plot" files may be documented using the 2313, they cannot be re-displayed on the 2032 or 2034. For this purpose it is recommended that measurements are recorded using the **Digital I/O** "Output" key of the Analyzers to initiate read out to the 7400.

For further information on the use of the 2032 or 2034 Signal Analyzers, their Instruction Manuals should be consulted.

6. DATA TRANSFER OVER THE IEC INTERFACE

6.1. INTRODUCTION

The digital interface of the Type 2313 is designed according to the standard IEC 625-1 "Interface for Programmable Measuring Apparatus Byte-Serial Bit Parallel". Since the only significant difference between this and the IEEE Standard 488 – 1978/ANSI MC1.1 – 1975 is the type of connector used, compatibility with these standards is only a question of which connecting cable is used. Connection of the Type 2313 to an IEC 625-1 interface bus system is made from the IEC BUS connector on the rear panel of the Type 2313 using cable AO 0194. Connection to an IEEE/ANSI interface bus system is made from the same connector using cable AO 0194 and adaptor AO 0195. Connection to an earlier B & K instrument fitted with a female, slide-lock connector, is made using cable AO 0184. For further details of instrument interconnections, refer to the B & K publication "INTERFACING BRÜEL & KJÆR INSTRUMENTS".

It is important to note that although the Type 2313 interface is designed according to the IEC standard, absolute compatibility with IEC or IEEE/ANSI interfaces designed by other manufacturers cannot be unconditionally guaranteed, since differences can occur within the limits of the specifications. Any problems encountered, however, will be of a software rather than a hardware nature. Where compatibility is in doubt, contact our local representative for details.

6.2. IEC FUNCTIONS IMPLEMENTED

The interface of the Type 2313 implements the following functions, as specified by the IEC standard. The clauses referred to are the relevant sections of the IEC publication specifying the functions. The equivalent sections in the IEEE/ANSI standard are given in parentheses.

Clause 6, Source Handshake (SH) Interface Function, (Section 2,3)
SH 1 — complete capability
Clause 7, Acceptor Handshake (AH) Interface Function, (Section 2,4)
AH 1 — complete capability
Clause 8, Talker (T) Interface Function, (Section 2,5)
T5 — complete capability
Clause 9, Listener (L) Interface Function, (Section 2,6)
L3 — complete capability
Clause 10, Service Request (SR) Interface Function, (Section 2,7)
SR 1 — complete capability
Clause 11, Remote Local (RL) Interface Function, (Section 2,8)
RL 1 — complete capability
Clause 12, Parallel Poll (PP) Interface Function, (Section 2,9)
PP 1 — remote configuration
Clause 13, Device Clear Interface (DC) Function, (Section 2,10)
DC 1 — complete capability

Clause 15, Controller Interface (C) Function, (Section 2,12)

- C1 — system controller
- C2 — send interface clear (IFC) and take charge
- C3 — send remote enable (REN)
- C4 — respond to service request (SRQ)
- C5 — send interface messages, receive control, pass control, pass control to self, parallel poll, take control synchronously

All other functions no capability

For further details of the above functions, refer to the relevant sections of the IEC or IEEE/ANSI standards.

6.3. ADDRESSING THE TYPE 2313

Each device in an IEC interface bus system has at least one listener and/or talker address depending on its function. When an interface controller contacts a device over the IEC interface, it sends a device address, which will contain the appropriate talker or listener address. This address is in ISO 7-bit code (or equivalent ASCII), bit 8 being unused for addressing, therefore remaining at logic 0. Table 6.1 gives a list of possible

ASCII Address Characters		ADDRESS SWITCH					Address Code	
Listen	Talk	A5	A4	A3	A2	A1	decimal	octal
SP	@	0	0	0	0	0	0	0
!	A	0	0	0	0	1	1	1
"	B	0	0	0	1	0	2	2
#	C	0	0	0	1	1	3	3
$	D	0	0	1	0	0	4	4
%	E	0	0	1	0	1	5	5
&	F	0	0	1	1	0	6	6
'	G	0	0	1	1	1	7	7
(	H	0	1	0	0	0	8	10
)	I	0	1	0	0	1	9	11
*	J	0	1	0	1	0	10	12
+	K	0	1	0	1	1	11	13
,	L	0	1	1	0	0	12	14
–	M	0	1	1	0	1	13	15
.	N	0	1	1	1	0	14	16
/	O	0	1	1	1	1	15	17
0	P	1	0	0	0	0	16	20
1	Q	1	0	0	0	1	17	21
2	R	1	0	0	1	0	18	22
3	S	1	0	0	1	1	19	23
4	T	1	0	1	0	0	20	24
5	U	1	0	1	0	1	21	25
6	V	1	0	1	1	0	22	26
7	W	1	0	1	1	1	23	27
8	X	1	1	0	0	0	24	30
9	Y	1	1	0	0	1	25	31
:	Z	1	1	0	1	0	26	32
;	[	1	1	0	1	1	27	33
<	\	1	1	1	0	0	28	34
=	]	1	1	1	0	1	29	35
>		1	1	1	1	0	30	36

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Table 6.1. 2313 Address Switch settings (shaded area factory setting)

ADDRESS SWITCH settings with the corresponding device address in the form of ASCII characters for the different address modes.

Note that in a system where the Type 2313 is a controller, it is not necessary to set the address of the 2313 in order to operate the system. It will, however, be necessary to set the addresses of the other instruments in the system to their factory setting, which can be found in the relevant instruments instruction manual or on the label attached to the Application Package.

6.3.1. Setting the Address Switches

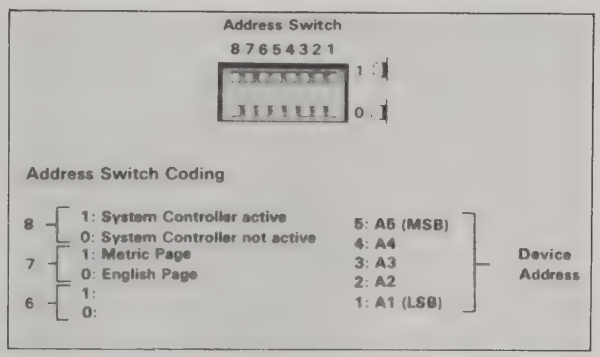

Fig. 6.1. Address Switch on the rear panel of the 2313

The listen and talk addresses over which the 2313 can be contacted via its IEC interface are selected by the **Address Switches** on the rear panel. For each switch pair, depressing the upper switch will give a logic 1 and depressing the lower switch will give a logic 0. The most significant bit (MSB) of the address is given by switch pair A5, while the least significant bit (LSB) is given by switch pair A1.

Switch pair 6 is unused, whilst switch pair 7 is for setting the page size to 'English' or 'Metric'.

Switch pair 8 is for activating or deactivating the 2313 as a system controller. When set at logic 0 ("System Controller not active"), the system controller function of the 2313 is deactivated, which enables the "Listen Only" mode to be activated manually (Section 6.4.1), or enables the 2313 to be operated remotely as described in Sections 6.4 to 6.12. This might imply that the 2313 works as an IEC controller but not as a system controller. However, the functions in the Application Package, as described in Section 1, may still be utilised. When set at logic 1 ("System Controller active"), the system controller function is activated and the 2313 can be used via its front panel pushbuttons to control itself and other instruments depending on the Application Package used (see Section 1). If the 2313 is to be used as a system controller then Sections 6.4 to 6.12 may be ignored.

On delivery, **Address Switch** numbers A1 to A5 on the rear panel of the Type 2313 are set to 00001, and switch pair 8 set to "System Controller active". Other address codes may be selected as required without influencing the operation of the 2313. In a 2313/BZ 7001 system with the Type 2131 and Type 7400, it is not necessary to set the address switches A1 to A5 of the 2313.

Note that after activating any of the switches, it is necessary to press "Reset" or power off and then power on again.

6.4. MODES OF OPERATION

The following sections (6.4 to 6.12) require that **Address Switch** 8 is set to "System Controller not active".

6.4.1. Listen Only Mode

In this mode, the 2313 will print out any data on the interface bus. This mode is accessed manually by pressing **Reset** followed by **Exec./Ent.**

The **Listen**, **Entering** and **Exec./Ent.** LEDs will illuminate, indicating that the 2313 is in the "Listen Only" mode and ready to print data as described in Section 6.12.

Note: To return to the normal remote controllable mode, press Reset manually or clear the 2313 via the interface bus by sending ⟨DCL⟩, ⟨SDC⟩ or ⟨IFC⟩.

6.4.2. Remote/Local Operation

In addition to manual control, the 2313 can be controlled via the interface bus. Three control modes exists:

Local Mode: Some front panel controls can be used by the operator. Full manual control requires that switch 8 is set to "System Controller active" or the 2313 has received the MASTER Job (Section 6.6.3). Avoid using the setup mode except for setting the clock.

Remote Mode: The 2313 can be controlled either remotely, or manually as in local mode.

Remote Mode with Local Lockout: Only remote control is possible, however, it is still possible to carry out a manual Reset.

6.5. THE INTERFACE JOB

Section 6.4.1 describes how to manually bring the 2313 in a mode ready for printing. For remote control over the interface bus, various Jobs can be specified, a list of which is given in Table 6.2.

A general diagram of the Job syntax is given in Fig. 6.2. The 'Job Header' describes the job to be carried out. This consists of one word which may be written in its entirety but may be shortened at least until the underlined part of the word.

Example: PRINTER ⟨LF⟩ or
PRINT ⟨LF⟩ or
PR ⟨LF⟩

will give the same result.

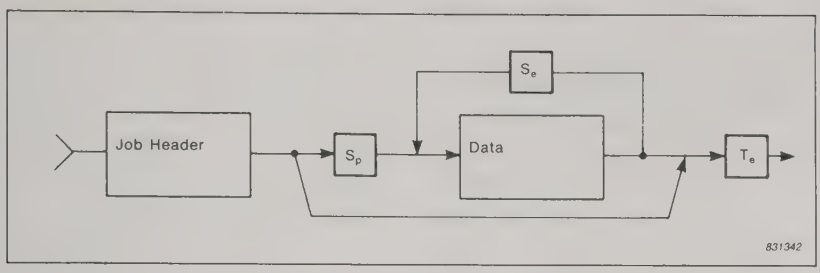

Fig. 6.2. Job syntax diagram

The 'Data', if present, is used to further specify the job. To separate the 'Job' from the Data, a separator S_p is used. Data may be formatted by a Separator S_e. The Job specification ends with a terminator T_e. The following separators and terminator are used:

S_p = ⟨Space⟩

S_e = ⟨ , ⟩

T_e = ⟨LF⟩ or ⟨EOI⟩ with any character.

The character to be sent is the character **between** the brackets – not the brackets themselves. Errors in the job specification will cause the 2313 to send an SRQ (Service Request) if the Service Request function is enabled by the Job specification SRQENABLE (see Section 6.6.11), otherwise an error message will be printed and the 2313 will lock up. After pressing 'Reset' to clear the lock up, the Service Request function will be disabled.

6.6. JOBS IN THE BZ 7001

This Section gives a descripton of each of the Jobs available in the BZ 7001 accompanied by a syntax diagram and an example of a program line. A list of interface Jobs is given in Table 6.2. Note that the word can be shortened up to the underlined part, e.g., 'DEFAULT' can be written as 'D', 'DE', 'DEF', etc.

Interface Job	Section	Interface Job	Section
DEFAULT	6.6.1.	SRQENABLE	6.6.11.
FUNCTION	6.6.2.	SRQDISABLE	6.6.11.
MASTER	6.6.3.	TEST	6.6.12.
NEWSETUP	6.6.4.	TEXT0	6.6.13.
PAGE	6.6.5.	TEXT1	6.6.13.
PRINTER	6.6.6.	TEXT2	6.6.13.
REPEAT	6.6.7.	TEXT3	6.6.13.
RETURNADR	6.6.8.	TEXT4	6.6.13.
SETUP	6.6.9.	TOPPAGE	6.6.14.
SHOWTIME	6.6.10.		

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Table 6.2. List of interface Jobs in alphabetical order

6.6.1. DEFAULT

Sets the current setup parameter values to default (from setup 0).

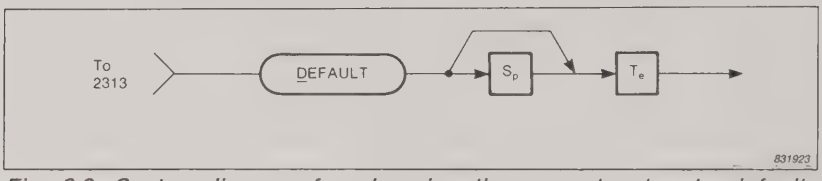

Fig. 6.3. Syntax diagram for changing the current setup to default values

Example of Use

DEFAULT T_e

6.6.2. FUNCTION

In the preceeding chapters, it is described how to use the 2313 functions such as **List**, **Plot** etc. The syntax diagrams in these chapters describe how to select functions and their associated parameters. The same functions and their parameters may be selected via the interface, using other separators between the function and parameter.

No.	Main Function Name
0	List
1	Plot
2	Memory
3	Cont. Memory
4	7400
5	2131
6	Delete
7	Memory Menu
8	Plot Spectra
9	Record Spectra

No.	Extended Function Name
13	Trig
32	Multi Sub.
33	Multi Add
111	Execute 7400 Program
112	Store 7400 Program
120	Relay on
121	Relay off
122	Set Unit Index*

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* see text

Table 6.3. List of BZ7001 main and extended functions selectable over the interface using the given function number

No.	Sub-function Name
1	*Last*
2	*Memory*
3	*C. Memory*
4	*7400*
5	*2131*
16	*1/12 Octave*
17	*Average*
18	*Deviation*
19	*Time decay curve*
20	*Simultaneous*
21	*Reverberation*
22	*Sub. Spectra*
23	*Add Spectra*
24	*7400 file to BZ7001 file*

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Table 6.4. List of BZ7001 sub-functions selectable over the interface using the given sub-function number

Fig. 6.4 gives a general syntax diagram to activate one of the BZ 7001 functions listed in Table 6.3, or sub-functions listed in Table 6.4. Detailed information on parameters can be found in the description of the actual function in the previous sections. As an example, a syntax diagram of the function 'Plot', is given in Fig. 6.5.

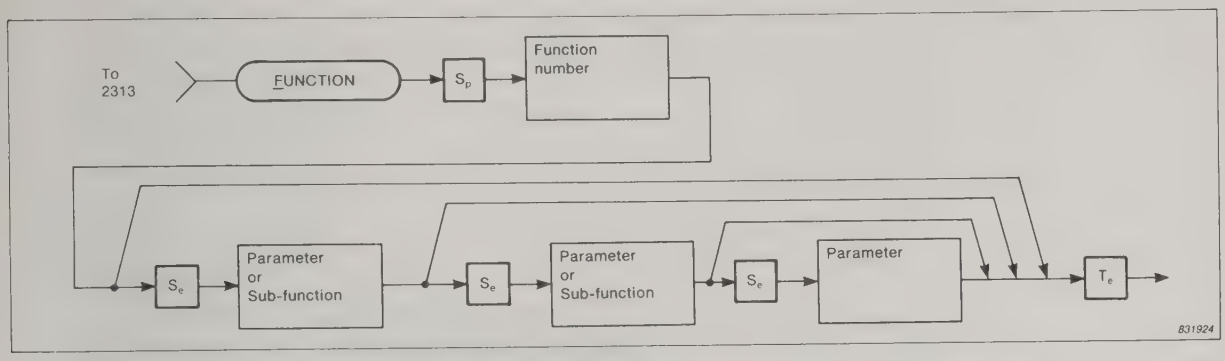

Fig. 6.4. General syntax diagram for activating one of the 2313 functions

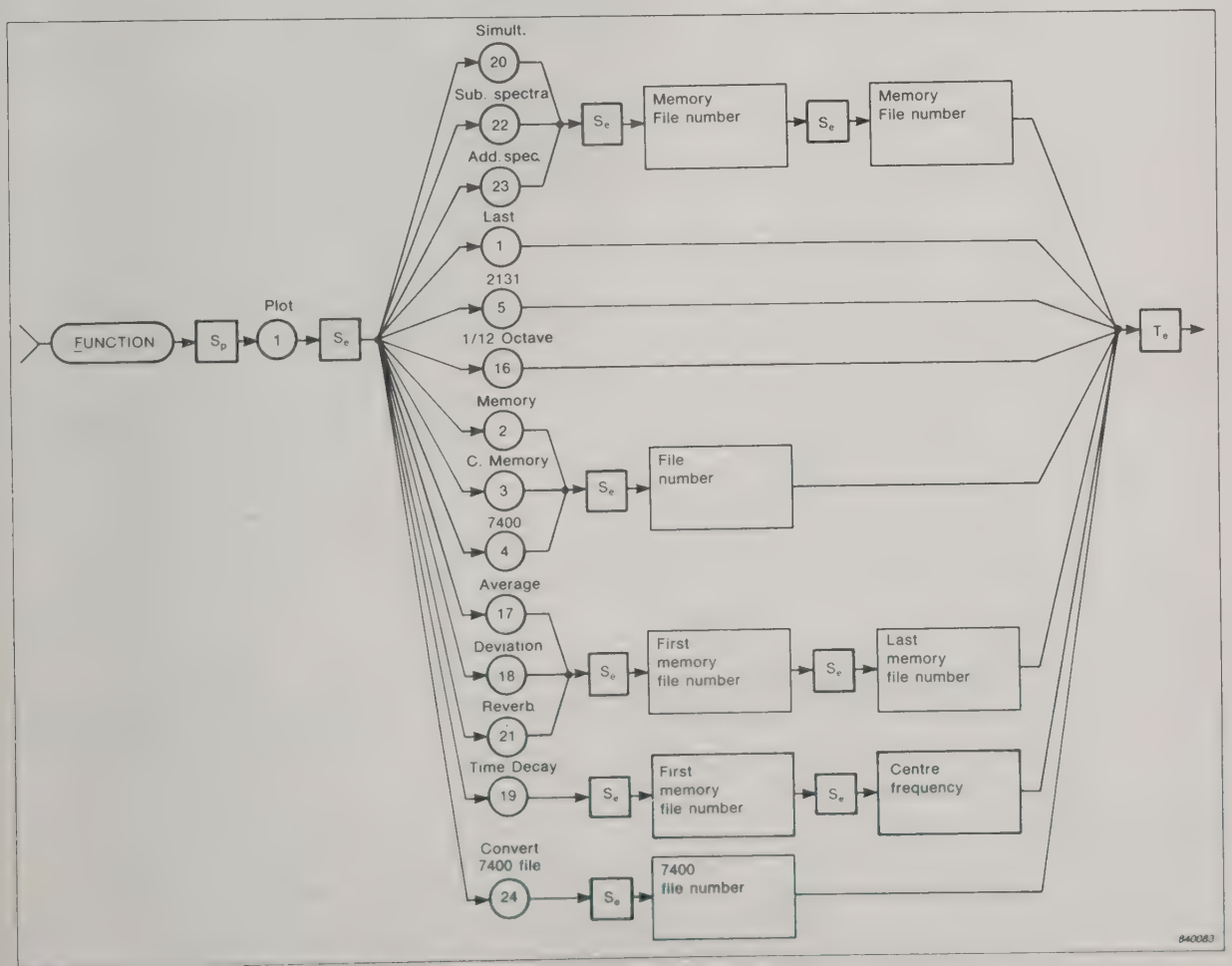

Fig. 6.5. Syntax diagram for activating the 'Plot' function

Examples of Use

RETURNADR R T_e
FUNCTION 1 , 17 , 3 , 8 T_e — Enables the Plot function
〈TCT〉 — The control character commands the 2313 to take control

This example will result in plotting of an average of the files from 3 to 8 inclusive.

FUNCTION 122 , 13 , 3 , 1 T_e — Sets the Unit field for the Trig parameter number 3 to 'sec.'

Notes

Function no. 122 in Table 6.4 is used for setting the UNIT field in the setup and can only be accessed over the interface.

See Section 6.7 for further information on passing control.

The 2313 gives up control on completion of the function, therefore this Job should be preceeded by RETURNADR (Section 6.6.8). The selected 2313 function will be initiated on passing control to the 2313.
The system controller must not operate the 2313 until the function is executed and the 2313 has passed the control back to the system controller.

6.6.3. MASTER

Allows the 2313 to be controlled manually using the front panel pushkeys (or remote terminal — see Section 7).

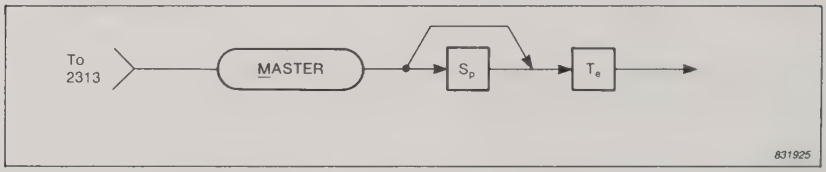

Fig. 6.6. Syntax diagram for controlling the 2313 via the front panel

Example of Use

MASTER T_e
〈TCT〉 — The system controller passes control to the 2313.

Notes

This Job should be followed by passing control of the bus to the 2313, see Section 6.7. Control is released when 'Reset' is activated. The system controller may take control by sending 〈IFC〉.

6.6.4. NEWSETUP

Specifies which of the 4 setups is to be the current set up.

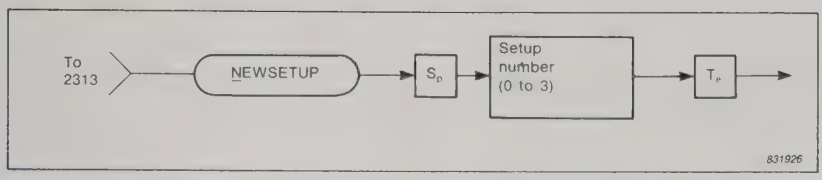

Fig. 6.7. Syntax diagram for selecting current setup

Example of Use

NEWSETUP 2 T_e Selects setup number 2 to be the current setup

6.6.5. PAGE

The remainder of a page will be fed.

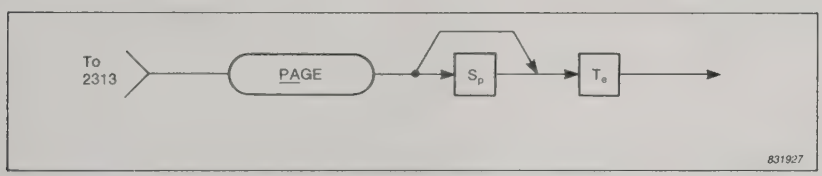

Fig. 6.8. Syntax diagram for paper feed of the remainder of the page

Example of Use

PAGE T_e

Notes

The page size is determined by the setting of the **Address Switch** pair 7.

6.6.6. PRINTER

Brings the 2313 to work in a printer mode as described in Section 6.12.

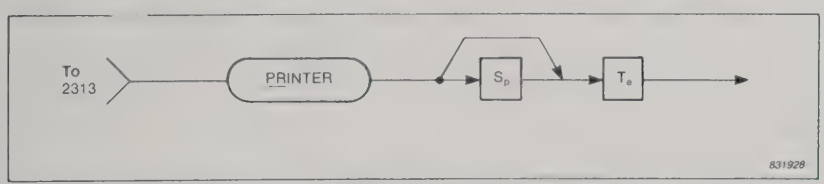

Fig. 6.9. Syntax diagram for selecting printer mode

Example of Use

PRINTER T_e

Notes

Once set, the 2313 will remain in the printer mode until cleared remotely (Section 6.11), or by pressing **Reset** on the front panel.

6.6.7. REPEAT

Repeats the previously executed FUNCTION or TEST. Has the same effect as pressing **Exec./Ent.** in manual mode.

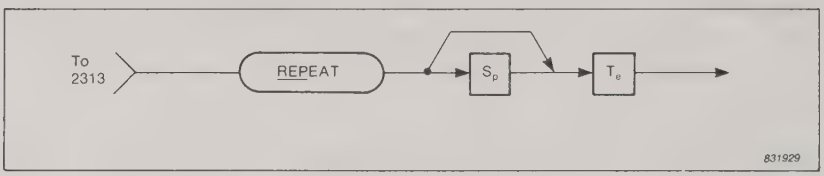

Fig. 6.10. Syntax diagram for repeating previous FUNCTION or TEST

Example of Use

RETURNADR S T_e
REPEAT T_e
〈TCT〉

The control character 〈TCT〉 commands the 2313 to take control.

Notes

See Section 6.7 for further information on passing control.

The 2313 gives up control on completion of the function, therefore this Job should be preceeded by RETURNADR (Section 6.6.8). The selected 2313 function must be started by passing control to the 2313.

The system controller must not operate the 2313 until the repeated function is executed and the 2313 has passed the control back to the system controller. This time depends heavily on the repeated function.

6.6.8. RETURNADR

Specifies the address to which control should be returned on completion of a function which requires that the 2313 has control over the interface. This specification must always preceed the following jobs: FUNCTION, MASTER, REPEAT, TEST.

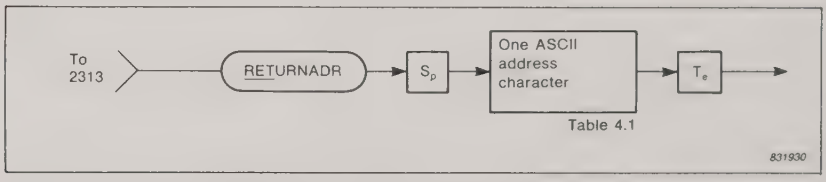

Fig. 6.11. Syntax diagram for specifying return address

Example of Use

RETURNADR U T_e

Enables control to be returned to a system controller with an address corresponding to the ASCII character 'U' (decimal 85)

Notes

This return address will be remembered by the 2313 until the 2313 is cleared by 〈DCL〉, 〈SDC〉 or in the case of an aborted function by 〈IFC〉.

6.6.9. SETUP

Enables new parameter values to be added to the current setup.

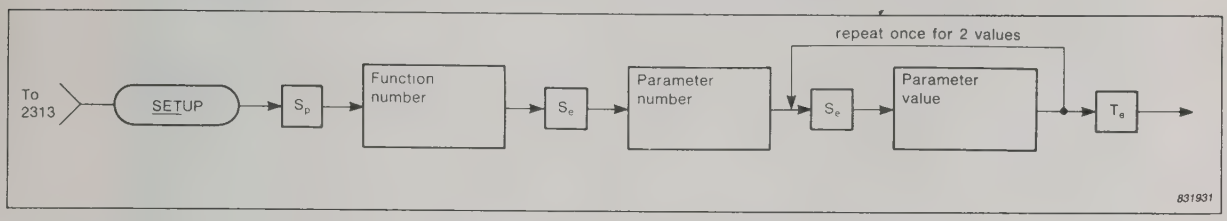

Fig. 6.12. Syntax diagram for changing setup values

Example of Use

SETUP 1 , 3 , 500 T_e	Plot from 500 Hz
Wait	
〈SDC〉	
SETUP 2 , 1 , 3 , 12 T_e	Memory 3 to 12 store-secured
Wait	
〈SDC〉	
SETUP 13 , 2 , 10 T_e	Trig level 10 dB
Wait	
〈SDC〉	
SETUP 17 , 1 , 0 T_e	Averager not arithmetical
Wait	
〈SDC〉	
SETUP 200 , 1 , –1 T_e	Add lin and A-weight channels.
Wait	
〈SDC〉	

Notes

Note the necessity of sending an 〈SDC〉 or a 〈DCL〉 after each setup command. After the SETUP command and before the clear, a wait of 20 msec. is necessary. A check as described in Section 6.7 and 6.8 may be performed.

From the list in Fig. 6.13, one can obtain function numbers, parameter numbers and values. This list contains default values i.e. from setup 0. Note that it is not possible to change the UNIT using the SETUP function, instead use function no. 122 (see Section 6.6.2).

The parameter values **Yes** and **No** are selected by writing –1 for **Yes** and 0 for **No**.

To select another setup, use NEWSETUP (Section 6.6.4).

```
SELECTED SETUP NO.: 0
      FUNCTION                PARAMETER                          VALUE        UNIT
       0 List                 1 List from                  :        0          Hz
       0 List                 2 List to                    :    22000          Hz
       0 List                 3 Including head             :  YES
       1 Plot                 1 Graphic offset             :        0          dB
       1 Plot                 2 Scale proportion, 25dB/    :        5          cm
       1 Plot                 3 Plot from                  :        0          Hz
       1 Plot                 4 Plot to                    :    22000          Hz
       1 Plot                 5 Graphic offset             :        0          s
       1 Plot                 6 Scale proportion, 2.5s/    :        5          cm
       2 Memory               1 Store-secured              :       -1      -1
       3 Cont. memory         1 Store-secured              :       -1      -1
       6 Delete               1 Memory secured             :       -1      -1
       6 Delete               1 Cont. memory secured       :       -1      -1
       8 Plot spectra         1 Grid                       :  No
       9 Record spectra       1 No. of averages            :        1
       9 Record spectra       2 Source control             :  No
       9 Record spectra       3 Spectrum sample interval   :        2          * 22ms
       9 Record spectra       4 Wait between averages      :        0          s
       9 Record spectra       5 Sound build-up             :        2          s
(/  3) 13 Trig                1 Active                     :  NO
(/  3) 13 Trig                2 Level                      :        0          dB
(/  3) 13 Trig                3 Time over level            :        0          * 22ms
(/  3) 13 Trig                4 Decreasing level           :        5          dB
(/  3) 13 Trig                5 Frequency                  :     1000          Hz
(/100) 110 Personal text      1 Enable line 0              :  NO
(/100) 110 Personal text      2 Enable line 1              :  NO
(/100) 110 Personal text      3 Enable line 2              :  NO
(/100) 110 Personal text      4 Enable line 3              :  NO
(/100) 110 Personal text      5 Enable line 4              :  NO

      SUBFUNCTIONS:
       16 1/12 octave         1 Man. scan                  :  NO
       16 1/12 octave         2 Valid low freq. in auto.   :       80          Hz
       17 Average             1 Arithmetical               :  YES
       18 Deviation           1 Arithmetical               :  YES
       19 Time decay curve    1 Number of files            :       39
       19 Time decay curve    2 Show reverb. interval      :  No
       21 Reverberation       1 Determination interval     :       -5      -35  dB
       22 Sub. spectra        1 Arithmetical               :  YES
       23 Add spectra         1 Arithmetical               :  YES

      COMMON SETUP:
      200 Add Lin and A       1 Lin and A weight channel   :  NO
```

OP2313AA0

Fig. 6.13. 2313 listing of BZ 7001 functions with function numbers, parameters with parameter numbers and default values

6.6.10. SHOWTIME

Results in a print-out of date and time.

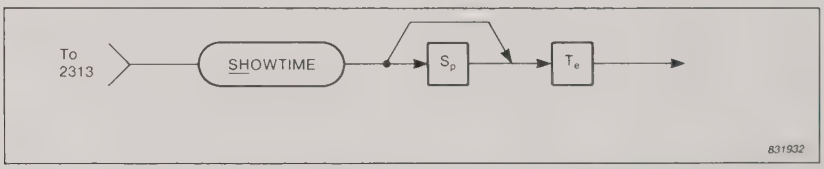

Fig. 6.14. Syntax diagram for read-out of date and time

Example of Use

SHOWTIME T_e

6.6.11. SRQENABLE
SRQDISABLE

SRQENABLE enables the 2313 to send out a service request (SRQ) in the case of a Job specification error, an error during the Job, or lack of paper.

SRQDISABLE disables the 2313 from sending out a service request.

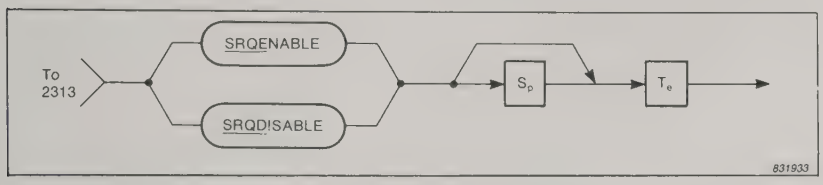

Fig. 6.15. Syntax diagram for SRQ enabling and disabling

Example of Use

SRQENABLE T_e

Notes

When an error occurs, the 2313 will lock until a serial poll has been carried out (see Section 6.10), or until the 2313 is cleared (See Section 6.11).

6.6.12. TEST

Carries out a test of the 2313 and gives a print-out for inspecting the printer head quality.

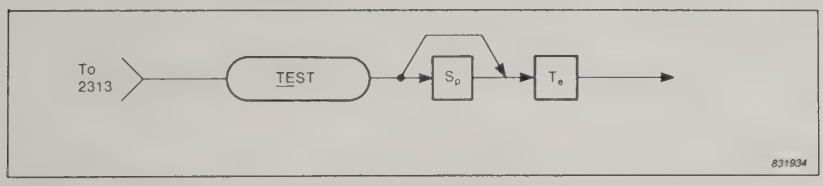

Fig. 6.16. Syntax diagram for 2313 self-test

Example of Use

RETURNADR W T_e
TEST T_e
〈TCT〉 The control character 〈TCT〉 commands the 2313 to take control

Notes

See Section 6.7 for further information on passing control.

This command must be preceeded by RETURNADR (Section 6.6.8), for returning control on completion of the test, and control should be passed to the 2313 in order to start the test. The system controller must not operate the 2313 until the test is finished and the 2313 has passed control back to the system controller (approx. 3 minutes).

6.6.13. TEXT0
TEXT1
TEXT2
TEXT3
TEXT4

Inserts text in the relevant textline.

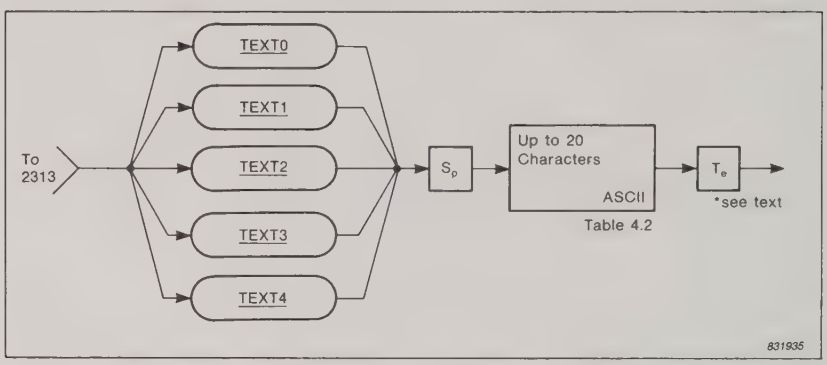

Fig. 6.17. Syntax diagram for inserting text in the read-out textlines

Example of Use

TEXT0 1/12 Octave Spectrum ⟨EOI⟩ Inserts '1/12 Octave Spectrum' in textline 0 (top textline)

Notes

* ⟨EOI⟩ with the last character should be used as T_e and not ⟨LF⟩. If, however, the control characters including ⟨LF⟩ are used, then the special characters from Table 6.6 will appear in the text field, e.g., ⟨LF⟩ would give a ^{0}.

Each textline contains a maximum of 20 characters.

6.6.14. TOPPAGE

The current position will be defined as the top of page.

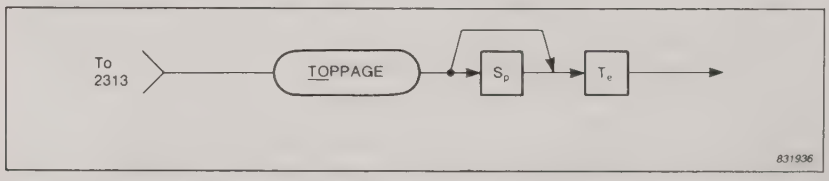

Fig. 6.18. Syntax diagram for setting the current position to top of page

Example of Use

TOPPAGE T_e

6.7. CHECKING THE JOB SPECIFICATION

During the development phase of the control program, it will be useful to know whether the job specifications sent to the 2313 are correct. In this case, the system controller must look for a Service Request 〈SRQ〉 message on the bus, (if service request is enabled), until the 2313 has checked the message.

It is important that the Take Control 〈TCT〉 message, if relevant, is not sent until the check is finished, as it is impossible for the system controller to perform a serial poll after it has passed the control to the 2313.

6.8. CHECKING FOR JOB ERRORS

Even if the job specification syntax is correct, the parameter numbers or values may be wrong.

While waiting for the 2313 to carry out its job, look for a possible service request 〈SRQ〉 message from the 2313.

Note that errors detected by the 2313 while having the IEC control, will lock the 2313 and can therefore not be investigated by the system controller. Such errors require an interface clear 〈IFC〉 which must be sent by the system controller after it has waited unsuccesfully for the job to finish. However, if the error is due to lack of paper, the 2313 will not lock but will send a service request 〈SRQ〉 message, if enabled, after it has completed the job.

6.9. ERRORS BY REMOTE CONTROL

Some typical errors which can occur are:

1. Forgetting to specify the return address for the system controller when required will result in:

   Job specification error Error No.: 18

2. Forgetting to pass control to the 2313 when required gives after about 5 seconds:

   IEC timeout Error No.:19

3. Misspelling job specifications gives:

   Job spec. error Error No.:18

4. Operating the system controller before the 2313 has passed the control back to the system controller will probably result in an error message from the system controller.

5. Wrong parameter no. or value used in SETUP gives various Error print outs — see error list in section 4.6.

For error printouts other than mentioned here please see the error list in section 4.6.

6.10. POLLING THE STATUS OF THE 2313

If the Service Request function is enabled (see Section 6.6.11), an error will cause an SRQ (Service Request signal — see Section 6.7 and 6.8). To locate the device asking for service and to get information about the cause of the error, a serial poll can be carried out by the system controller. The status byte of the 2313, read by the system controller carries the information stated in Table 6.5.

Bit No.	Status Message
8	*(not used and set false i.e. 0)*
7	2313 is asking for service
6	2313 is in an abnormal condition
5	2313 is busy carrying out a job
4	2313 is out of paper
3	*(not used and set false i.e. 0)*
2	2313 has detected a Job error
1	2313 has detected a Job specification error

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Table 6.5. Table of 2313 Status Messages

At the same time as bit 4 is set the 2313 will print:

Printing not allowed – Do check paper roll ERROR NO.: 0

If bit 1 is set, the 2313 will print:

Job specification error ERROR NO.: 18

and if bit 2 is set, the 2313 will print an Error No. other than 18 — refer to Error Code list.

A serial poll will clear this error condition if service request is enabled, otherwise a clearing by ⟨DCL⟩ or ⟨SDC⟩ has to be carried out (See Section 6.11).

Another method of polling the 2313 is the Parallel Poll. After the polling sequence is made by the system controller, a parallel poll will give the same information as bit 5 in the serial poll status byte. If an error is detected by Parallel Poll, a clearing by ⟨DCL⟩ or ⟨SDC⟩ must be carried out.

6.11. CLEARING THE 2313 VIA THE BUS

Device Clear ⟨DCL⟩ or Selected Device Clear ⟨SDC⟩

A Reset of the 2313 will be made clearing print buffer and job specification buffer as well as a running job. Stored memory files and interface functions will not be cleared.

Interface Clear ⟨IFC⟩

If the 2313 has been manually brought to the printer mode, the ⟨IFC⟩ will cause both a Reset as for a ⟨DCL⟩ and a reset of the interface functions. The same will be the result if the 2313 is locked by an error while having the IEC control.

If the 2313 previously has been remotely operated without locking by errors, then only the interface functions will be reset.

If a job requires that the 2313 has control over the bus, an ⟨IFC⟩ must not occur until the 2313 has finished its job and has given the control back to the system controller in an orderly way except in the case of a locking error.

Note: To ensure that a job will be executed, it is necessary to wait a certain time between job specifications and while the 2313 is being cleared.

6.12. PRINTING WITH THE 2313/BZ 7001

The following procedure for printing data transferred over the interface bus applies when the 2313 is in its 'printer' (or listen only) mode. This can be achieved manually as outlined in Section 6.4.1 or by addressing the 2313 and sending the job specification PRINTER as described in Section 6.6.6. The 2313 will then be in its 'printer' mode,

Bit Numbers b_4 b_3 b_2 b_1	b_8 b_7 b_6 b_5 0 0 0	0 0 0 1	0 0 1 0	0 1 1 1	0/1 1 0 0	0/1 1 0 1	1 1 1 0	1 1 1 1
0 0 0 0	NUL	DLE	SP	0	@ Δ	P π	`	p
0 0 0 1	SOH	DC1	!	1	A α	Q ∫	a	q
0 0 1 0	STX	DC2	"	2	B ²	R æ	b	r
0 0 1 1	ETX	DC3	#	3	C Σ	S σ	c	s
0 1 0 0	EOT	DC4	$	4	D δ	T τ	d	t
0 1 0 1	ENQ	NAK	%	5	E ∈	U ü	e	u
0 1 1 0	ACK	SYN	&	6	F φ	V √‾	f	v
0 1 1 1	BEL	ETB	'	7	G ω	W ‾	g	w
1 0 0 0	BS	CAN	(	8	H Ω	X ↑	h	x
1 0 0 1	HT	EM	)	9	I ∩	Y ↓	i	y
1 0 1 0	LF	SUB	*	:	J ∩	Z →	j	z
1 0 1 1	VT	ESC	+	;	K Ø	[←	k	{
1 1 0 0	FF	FS	,	<	L λ	\ ‾	l	¦
1 1 0 1	CR	GS	-	=	M μ	] ‾	m	}
1 1 1 0	SO	RS	.	>	N +	^ |	n	~
1 1 1 1	SI	US	/	?	O ■	‾ |	o	DEL

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Table 6.6. Table of ASCII (ISO 646 equivalent) characters showing also the special characters available on the 2313

accepting ASCII characters sent over the interface bus and printing them out on receipt of ⟨LF⟩ (Line Feed), ⟨EOI⟩ (End Or Identify), or when the 2313's buffer is full. Characters are stored in sequence in the buffer and are printed out with automatic line feeds inserted in the case of overflow.

By sending the appropriate command, given overleaf, the ASCII printer format can be altered, or the 2313 brought into its graphic mode. The 2313 can be unaddressed to isolate it from interface bus activity, however when re-addressed, the 2313 will remain in its 'printer' mode. Deactivating the 'printer' mode is achieved by sending DEVICE CLEAR or SELECTED DEVICE CLEAR (see Section 6.11), or by manually activating any of the Reset levels (see Section 3.4).

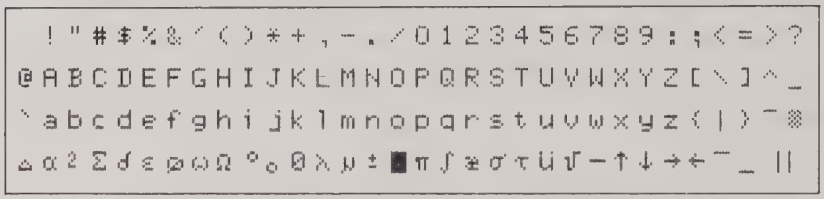


Fig. 6.19. Sample print out from the 2313 showing the alphanumeric characters available

The 2313 can print out all the non-control ISO characters as well as a range of special characters after receiving the ISO control character ⟨SO⟩ (see below). The range of control characters and their influence on the 2313 when in the 'printer' mode are listed below:

⟨LF⟩ Produces a line feed i.e. the current line is terminated and a new line started.

⟨FF⟩ Produces a form feed i.e. the current page is terminated and a new page started.

⟨SO⟩ The ISO characters between decimal 64 and 95 are replaced by special characters as shown in Table 6.6. This is maintained as long as the 2313 is in the 'printer' mode or until ⟨SI⟩ is sent.

⟨SI⟩ Returns the standard ISO character set if previously changed by sending ⟨SO⟩.

⟨ESC⟩ Notifies the 2313 of the start of a sequence, terminated by a ':', to change the printer format in 'printer' mode, or to access the graphic mode (see Sections 6.12.1 and 6.12.2).

The use of ⟨SO⟩, ⟨SI⟩ and ⟨ESC⟩ sequences conform to ISO 2022 (Code Extension Techniques).

6.12.1. Changing the Printer Format in 'Printer' Mode

Each standard character occupies a space of 8 pixels high by 6 pixels wide. The character height, distance between characters, line spacing can be altered as well as adding an underline. Fig. 6.20 gives the syntax of the sequence used to alter the format. The character height is a number between 1 and 4 (default is 2), where 1 is 1/2 of the standard height, 3 is 3/2 times the standard height etc. The space between characters is between

0 and 5 pixels (default is 0). The space between lines is between 0 and 7 pixels (default is 2). The underline feature underlines the following line only and is cancelled on receipt of ⟨LF⟩.

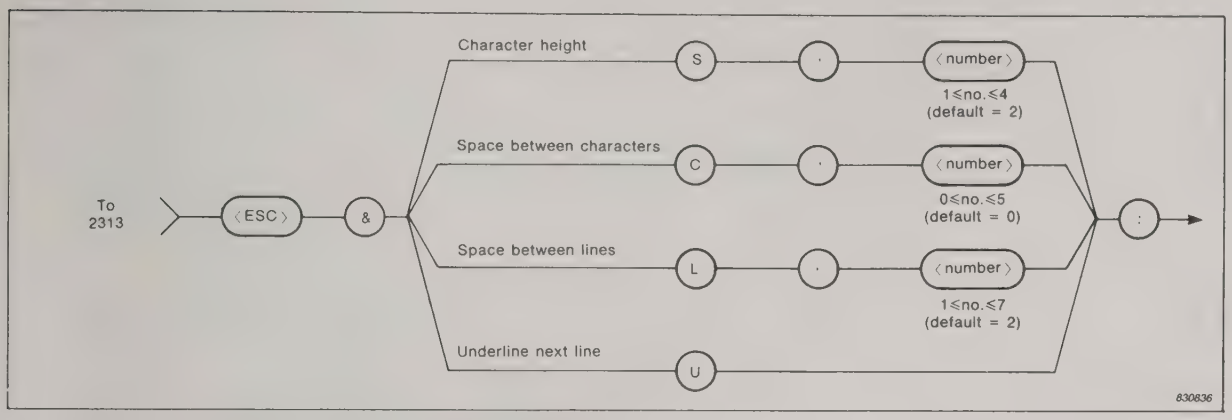


Fig. 6.20. Syntax diagram for altering the standard character format

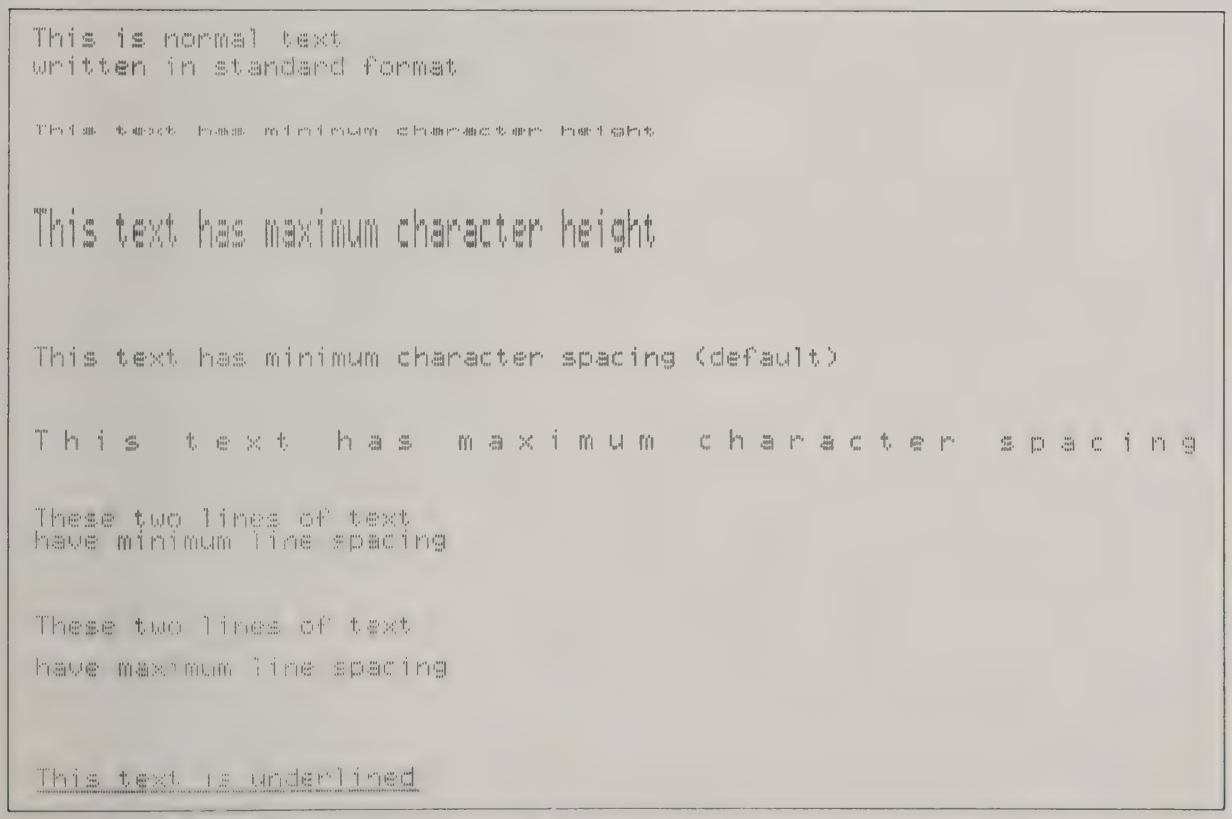

This is normal text
written in standard format
This text has maximum character height
This text has minimum character spacing (default)
T h i s t e x t h a s m a x i m u m c h a r a c t e r s p a c i n g
These two lines of text
have minimum line spacing
These two lines of text
have maximum line spacing
This text is underlined

Fig. 6.21. Sample print out from the 2313 showing various format possibilities

6.12.2. Changing to Graphic Mode

In the graphic mode, the binary data sent to the 2313 activate the pixels directly. Fig. 6.23 gives the syntax used when printing in graphic mode with an example of the construction of one graphic line given in Fig. 6.22. This specifies what binary data follows this ⟨ESC⟩ sequence and it is important that the following data is as specified. On completion of the graphic print-out, the 2313 returns to the normal ASCII mode. At this point and not before, a further ⟨ESC⟩ sequence can be initiated. The number of graphic lines is from 1 to 999 (default of 1). The number of graphic bytes per line is from 1 to 64 (default of 64 which is one complete line). The Graphic line start point is from 0 to 63 (default is 0 i.e. start at first line). Fig. 6.24 gives an example of a program, written for demonstrating the graphic mode. An example of the print-out obtained from this program is given in Fig. 6.25.

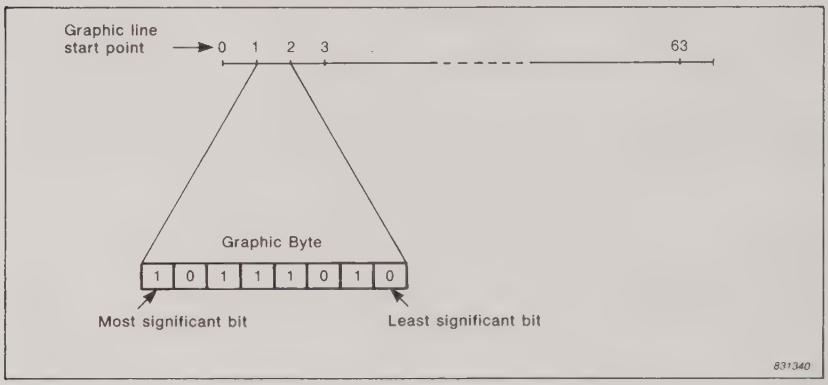


Fig. 6.22. Example of the construction of one graphic line

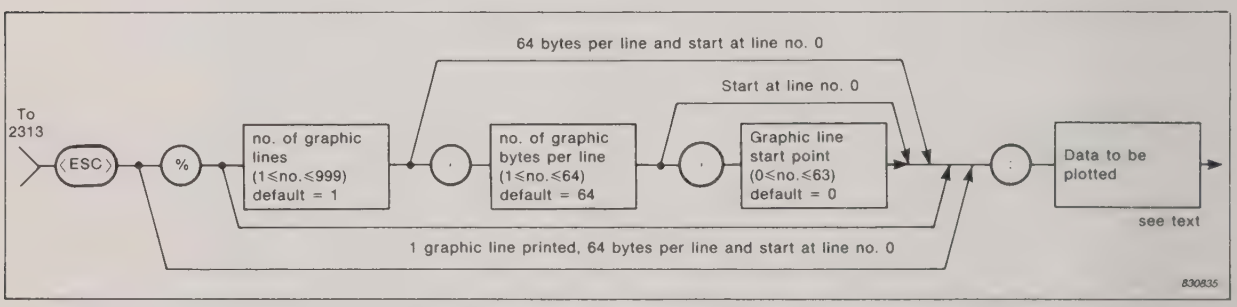


Fig. 6.23. Syntax diagram for plotting in the graphics mode

```
10    !
20    ! The following program reads in 30 values and
30    ! picture on the 2313 showing the values as a bit
40    !
50    ! The program is written on an HP 9826 with BASIC
60    !
70    ! 2'11 should be set to
80    ! address should be set to
90    !
100   !
110   COM Hist(1:30)                    ! The array 'Hist' is used for data,
120   INTEGER Pixel_array(1:200,1:30)
130   !
140   ! The array 'Pixel_array' is used to store 200 pixel-lines of 30 graphic
150   ! bytes (240 bits). Each graphic byte represents one channnel and is
160   ! stored as INTEGER's.
170   !
180   Min=1.E+9
190   Max=1.E-9
200   !
210   ! Read in data from keyboard:
220   !
230   FOR Ch=1 TO 30
240     DISP "VALUE CHANNEL";Ch;
250     INPUT Hist(Ch)
260     IF Hist(Ch)>Max THEN Max=Hist(Ch)   ! Find maximum
270     IF Hist(Ch)<Min THEN Min=Hist(Ch)   ! Find minimum
280   NEXT Ch
290   !
300   Range=Max-Min     ! Autoscaling
310   Plot_range=200    ! 200 pixel-lines are used for data
320   All_pixels=255    ! All 8 bits in one graphic byte is 1
330   No_pixels=0       ! All 8 bits in one graphic byte is 0
340   First_pixel=128   ! First bit (most significant bit) is 1
350   Last_pixel=1      ! Last bit (least significant bit) is 1
360   !
370   ! Generate the top frame line:
380   !
390   FOR Ch=1 TO 30
400     Pixel_array(200,Ch)=All_pixels   ! Set all 8 bit
410   NEXT Ch
420   !
430   ! Generate the data lines from top to bottom:
440   !
450   FOR Line=199 TO 1 STEP -1
460     FOR Ch=1 TO 30
470     IF Hist(Ch)-Min>=Plot_range*Line/
480       Pixel_array(Line,Ch)=All_pixels
490     ELSE
500       Pixel_array(Line,Ch)=No_pixels
510       IF Ch=1 THEN Pixel_array(Line,Ch)=First_pixel   ! Set left
520       IF Ch=30 THEN Pixel_array(Line,Ch)=Last_pixel   ! Set rig
530     END IF
540     NEXT Ch
550   NEXT Line
560   !
570   ! Generate the bottom frame line:
580   !
590   FOR Ch=1 TO 30
600     Pixel_array(0,Ch)=All_pixels   ! Set all
610   NEXT Ch
620   !
630   CLEAR 701                       ! Clear 2313
640   OUTPUT 701;"PRINTER"            ! Set 2313 in printer-mode
650   OUTPUT 701;CHR$(10);CHR$(10)    ! Send 2 Line-Feed
660   !
670   ! Print text:
680   !
690   OUTPUT 701;"
700   !
710   ! Dump the picture as 6030 bytes:
720   !
730   ! No. of lines: 201
740   ! No. of bytes per line: 30
750   ! Start point for all lines: 1
760   !
770   OUTPUT 701 USING "#,K,6030(B)";0
780
790   !
800   ! Print text:
810   !
820   OUTPUT 701;CHR$(10);
0";CHR$(10);CHR$(10)
830   !
840   END
```

Fig. 6.24. Example of a program to demonstrate the graphic mode of the 2313

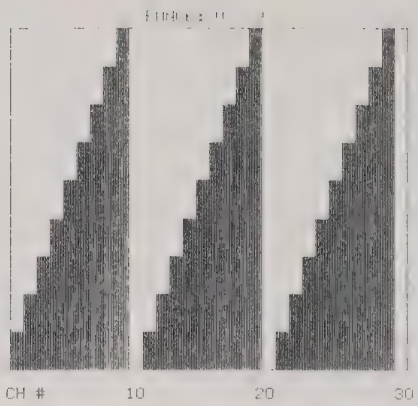


Fig. 6.25. Read-out obtained when running the program example in Fig. 6.24

7. THE SERIAL INTERFACE

7.1. INTRODUCTION

The Serial Interface in the 2313 conforms to the EIA Standard RS – 232 – C (equivalent to CCITT V 24). This standard ensures voltage level compatibility, identical pin wiring, and that certain control information supplied by one device can be understood by other devices. However, it is important to note that the interface may be used in various ways and that it is allowed to use more or less simple subsets of the standard.

To operate the interface is not only a matter of sending understandable data between the devices, but also to ensure that the device uses the number of control lines which is needed by the other device, that the number of bits and stop bits is correct and that the same baud rate, (data flow in bits per second), is selected in the two devices.

The following specifications apply to the Serial Interface of the 2313:

Number of bits: 8
Number of stop bits: 2
Parity: No
Mode of operation: Full duplex
Baud rate: 75 – 9600 Baud
Output level: ± 7 Volt nominal
Connector: 25-pin female
Syncronization method: None

The 2313 is coupled as a "Data Communication Equipment (DCE)" which is also called a modem. The device which is connected to the 2313 will normally be a "Data Terminal Equipment (DTE)" and have a 25-pin male connector. The baud rate may be selected up to 9600 baud, but in cases where a block of more characters are following rapidly after each other, it may be advisable to use a lower baud rate.

List of pins used:

1.	Protective ground	connected for chassis
2.	TDATA	Data **to** the 2313 (input)
3.	RDATA	Data **from** the 2313 (output)
5.	CTS	Clear to send (output)
6.	DSR	Data set ready (output)
7.	Signal Ground	Common return
8.	DCD	Data carrier detect (output)
20.	DTR	Data terminal ready (input)

The signals CTS, DSR and DCD are held true (high level) whenever the 2313 is turned on. The signal DTR is expected to be true but may in most cases be left unconnected. Consult the manual for the Data Terminal Equipment for possibly needed control signals.

7.1.1. Setting the 2313 Baud Rate

When a terminal is connected to the 2313 via its RS 232 interface and 'Reset' pressed, it is possible to insert personal text via the terminal or to remotely control the 2313. Before operating the terminal it may be necessary to set the baud rate to match that of the 2313 (factory set to 9600 bits/sec.). If necessary, the 2313 baud rate can be altered in factors of 2 from 9600 to 75 bits per second, by altering the jumper plug to a new position as shown in Fig. 7.1. The jumper plug is located on the printed circuit board on the inside of the back panel, accessible by removing the two screws securing the top panel and sliding the panel back. Ensure the mains power is disconnected before attempting to remove the top panel.

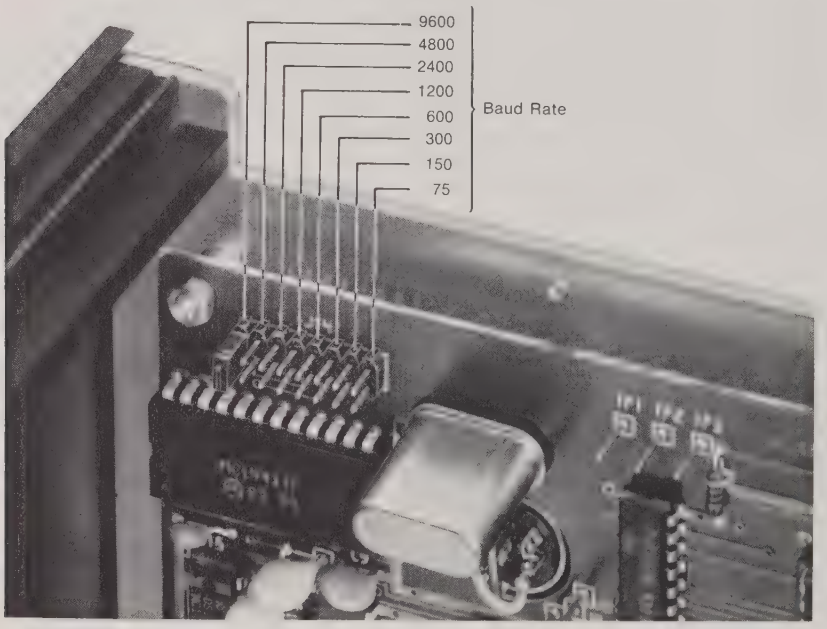


Fig. 7.1. Location of jumper plug for changing the baud rate

7.1.2. Personal Text

Prior to typing in the text, one of the textlines has to be selected then the characters can be typed in directly. Table 7.1 gives a list of the relevant pushkey commands.

Terminal	Result
G_c 0	select textline 0
G_c 1	Select textline 1
G_c 2	Select textline 2
G_c 3	Select textline 3
G_c 4	Select textline 4
G_c C	Clear selected textline and return to first character position
G_c T	Remote control of 2313 front panel, see Table 7.3
Another ASCII Control Character	A special character is put in the current position of the selected textline then incremented to the next character position, see Table 7.2
G_c 〈other ASCII character〉	Return to first character position in the selected textline
ASCII Character	The character is put in the current position of the selected textline then incremented to the next character position

T00112GB0

Table 7.1. Remote terminal pushbutton commands, where suffix c denotes a control character

In addition to the standard ISO characters, special characters can be entered from a list of control characters according to Table 7.2, e.g., N_c (Control N, equivalent to ISO control character SO) would give a ±.

Terminal	ISO	2313 Char.	Terminal	ISO	2313 Char.
$@_c$	NUL	Δ	P_c	DLE	π
A_c	SOH	α	Q_c	DC1	∫
B_c	STX	²	R_c	DC2	æ
C_c	ETX	Σ	S_c	DC3	σ
D_c	EOT	δ	T_c	DC4	τ
E_c	ENQ	ε	U_c	NAK	ü
F_c	ACK	φ	V_c	SYN	√
H_c	BS	Ω	W_c	ETB	–
I_c	HT	⁰	X_c	CAN	↑
J_c	LF	⁰	Y_c	EM	↓
K_c	VT	Ø	Z_c	SUB	→
L_c	FF	λ	$[_c$	ESC	←
M_c	CR	μ	$\backslash_c$	FS	¯
N_c	SO	±	$]_c$	GS	_
O_c	SI	■	$_c$	RS	|
			$-_c$	US	|

T00114GB0

Table 7.2. Table of remote terminal commands for writing special characters in the textline, where suffix c denotes a control character

7.1.3. Remote Control of the 2313 Front Panel

It is possible to remotely activate the front panel pushkeys via the terminal. To set the terminal for remote operation, key in G_c (Control G, equivalent to ISO control character BEL) followed by 'T', thereafter the 2313 will be controlled by the terminal according to Table 7.3. Remote control will cease on pressing the letter 'O' on the terminal.

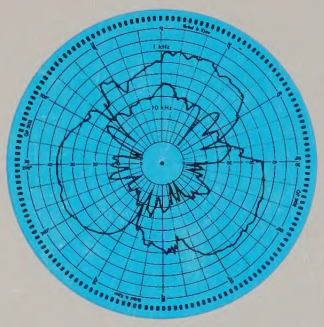
Terminal	2313 Front Panel	Terminal	2313 Front Panel
0	0	Y	Yes
1	1	E	E
2	2	N	No
3	3	/	/
4	4	W	Extension
5	5	C	Clear Entry
6	6	P	Page
7	7	H	Help
8	8	S	Setup
9	9	RETURN	Execute
–	–		
.	.	O	(cease remote control of 2313)

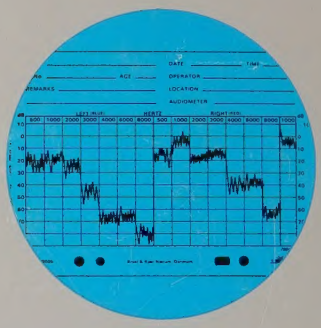
T00113GB0

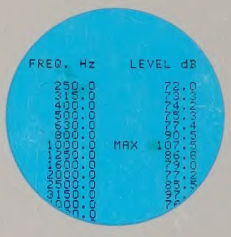
Table 7.3. Table of remote terminal commands for activating the 2313 front panel pushbuttons

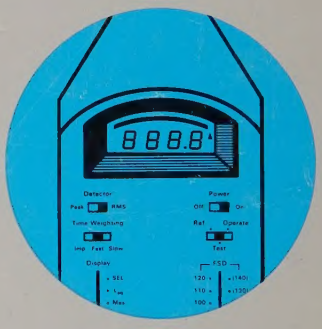
8. SERVICE AND REPAIR

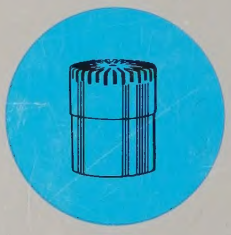
The 2313 is designed and constructed to provide the user with many years of safe, reliable operation. However, should a fault occur which impairs its correct function and possibly operating safety, then it should be immediately disconnected at the mains source and be secured against unintended operation. For repair consult the separate Service Instruction Manual for the instrument or contact your local B & K service representative. Under no circumstances should repair be attempted by persons not qualified in the service of electronic instrumentation.

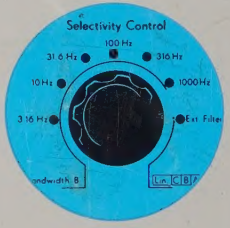


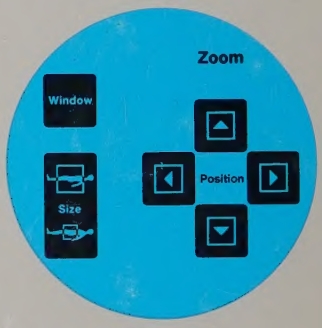


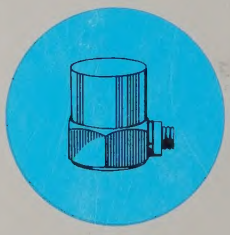


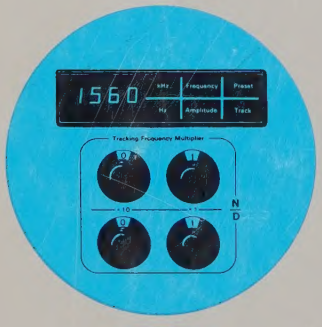


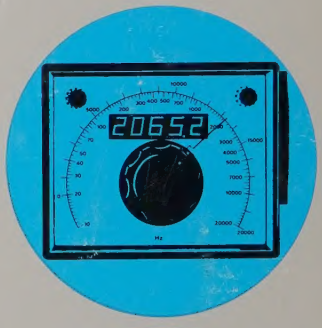


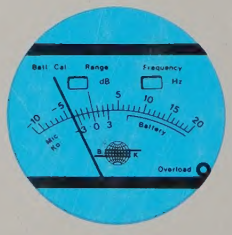


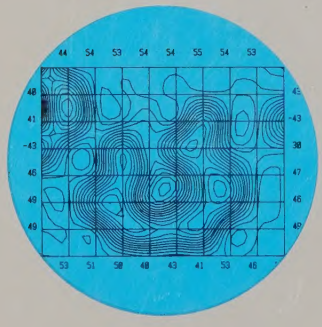


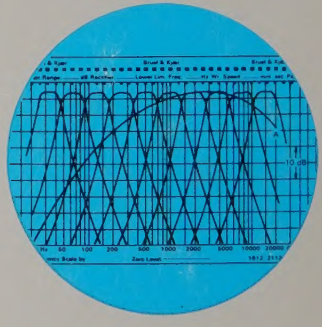












Brüel & Kjær DK-2850 NÆRUM, DENMARK · Telephone: + 45 2 800500 · Telex: 37316 bruka dk